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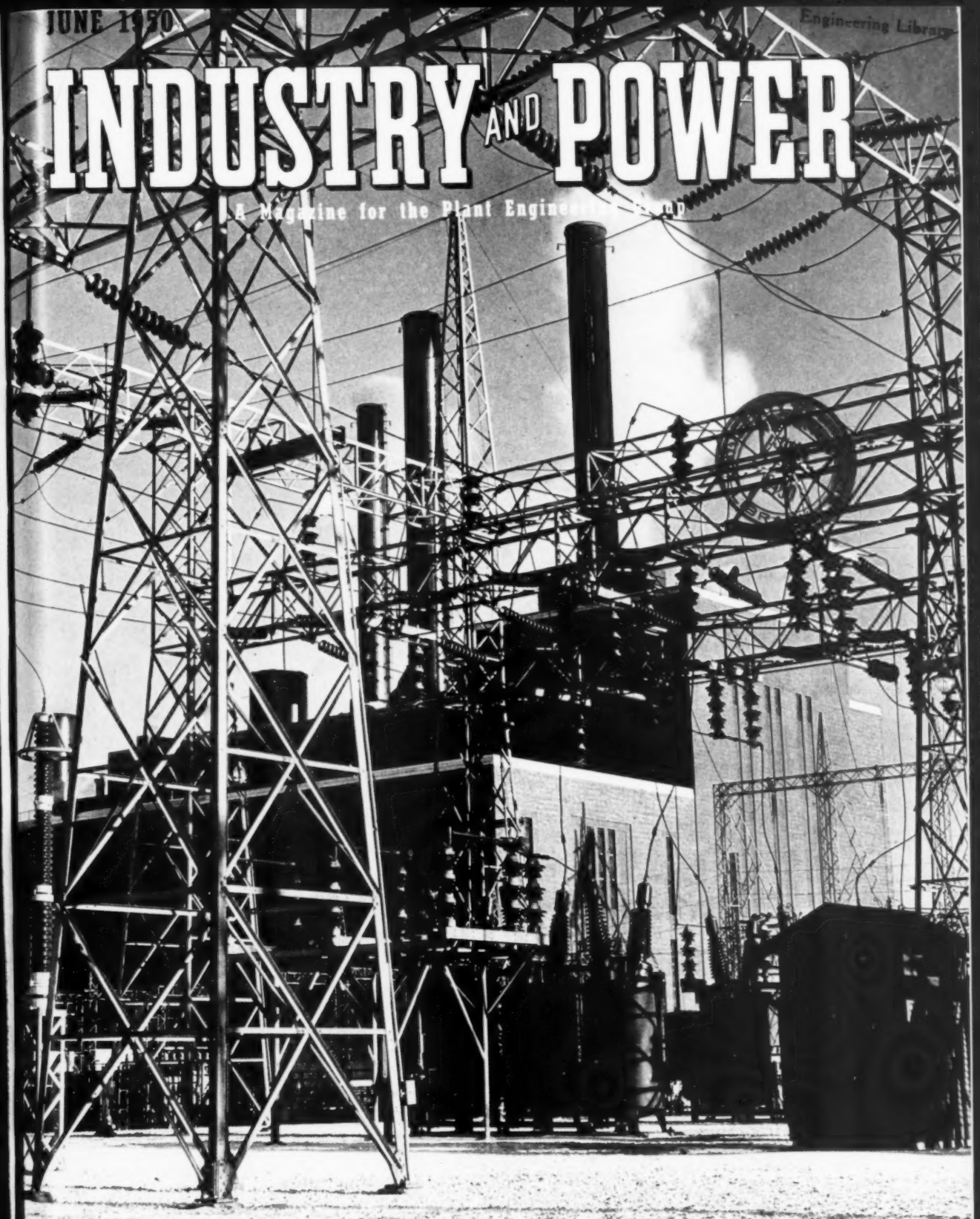
JUNE 1950

INDUSTRY AND POWER

A Magazine for the Plant Engineering Group



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PRETZEL BENDING *in the New Manner*

BY DIAMOND Roller Chain Driven AMF Pretzel Machines

Correct Timing Relationship

• To produce pretzels of the favored variety, American Machine and Foundry Company have perfected a machine that does the work mechanically.

For this ingenious automatic machine, non-slip Diamond Roller Chain Drives are used from main line shaft to jack shafts and from these shafts to the rolling boards and extruding mechanism which includes dough cut-off knives and friction clutch that drives the mechanical fingers. Exact timing relationship between the various mechanisms of the machine is maintained.

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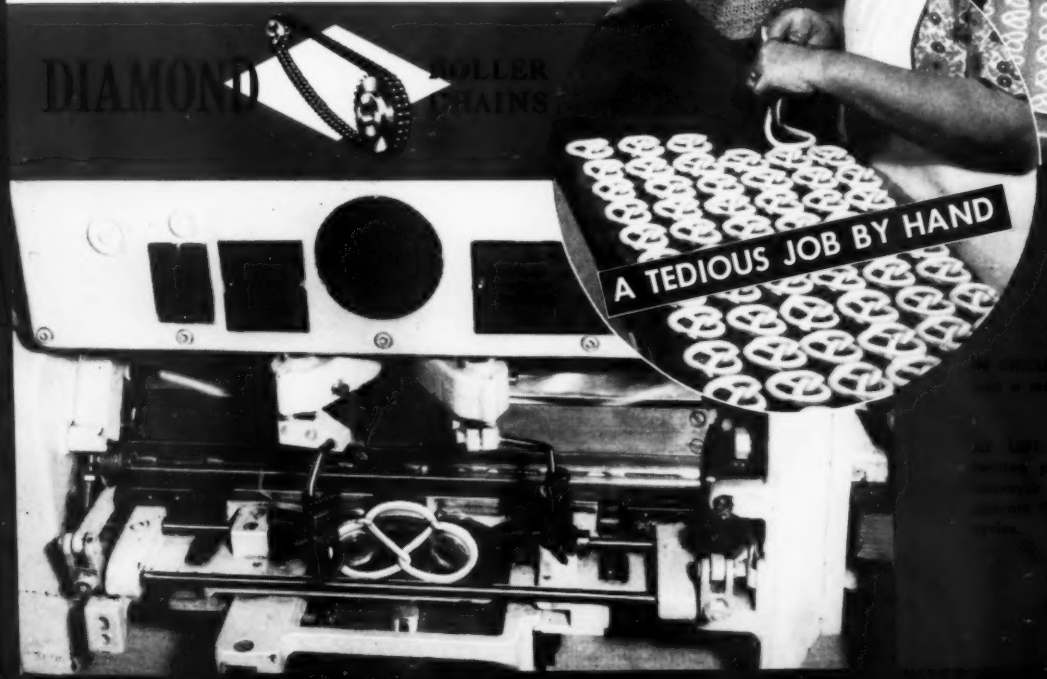

Edited particularly for the plant engineering group—those men responsible for the generation, transmission, distribution and utilization of energy in its various forms for power, processing and related plant services

INDUSTRY AND POWER

A Magazine for Engineers and Executives

VOLUME 58 — **JUNE, 1950** — NUMBER 6

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Cover Illustration

Power generated at the Twin Branch plant of the Indiana & Michigan Electric Co. at Mishawaka, Ind., flows through circuit breakers in the 132 kv yard in the foreground for transmission to the Southwestern Michigan and Northern Indiana area. In the background, the plant itself has an approximate 400,000 kw total capacity. Largest and latest of the turbines, No. 5, is served by a 930,000 lb per hr boiler at 2,000 psi and 1050 F. Fuel is pulverized coal. Turbines were built and installed by G-E.

FEATURE ARTICLES

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Monsanto Builds Ideal Process Steam Plant at Everett, Mass. 75
Robert Schaffner, Power Supt., Merrimac Div., Monsanto Chemical Co.
First high-pressure unit of multiple-boiler power plant has been installed. Although it is now operated at low pressure, it will ultimately be put on the line to generate byproduct electric power. Interesting innovations are incorporated in selection and installation of major auxiliaries, combustion-control equipment, and fuel-handling units.

Procedure for Correct Water-Tank Maintenance 80
Here are described the proper methods for inspecting and maintaining plant facilities that supply clean water to drinking fountains and processing operations. Scheduled maintenance programs are suggested.

Coal-Fired Gas Turbine Leaves Experimental Stage 83
J. I. Yellot, Director of Research, Locomotive Development Committee
This type turbine now appears ready to compete economically with any prime mover in the power field. The reasons are in this comprehensive article.

"More Power to America Special" Makes Inaugural Run 88
General Electric builds diesel-electric streamliner, and fills its 10 cars with more than 2,000 exhibits of products for the generation, utilization and distribution of electric power.

Correct Power Plant Cycle Applications are Essential—III 91

Chicago Pneumatic Boilers Meet Plant Needs with Low-Heat Coal .. 94
Long-range planning for manufacturing speed on production lines was carried through in designing the power services described in this article. Boilers carry plant load with 12,000-Btu coal.

Solutions to Your Problems in Feedwater Treatment 97
Dr. R. C. Ulmer, Technical Dir., Power Chemicals Div., E. F. Drew & Co., Inc.
Although considerable progress has been made in alleviating difficulties in the treatment of feedwater, Dr. Ulmer summarizes recent findings that may lead to solution of the remaining problems.

Automatic Speed Controls Meet Varied Requirements—I 102
Francis A. Westbrook

Symbols for Heat-Power Apparatus Developed for Design Work by ASA. 104

How to Select Corrugated Expansion Joints 106
A. B. White, Associate Editor, in collaboration with Chicago Metal Hose Corp., Expansion Joint Div.
Here are expansion data and engineering information for choosing and applying the proper joint to the individual job. Figures are presented to simplify expansion calculations for any length of pipe.

Diesels in a Hydroelectric System 111

PLANT ENGINEER'S HANDBOOK: Screw Conveyors 113
Wilbur G. Hudson, Consulting Engineer

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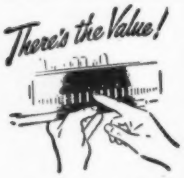
CONTROL of Scale begins with pH and PHOSPHATE DETERMINATIONS

BOILER WATER COMPARATORS

Model P contains either High or Low Phosphate Comparator. Model W contains same plus 3 pH slides (ph 7.2 to 8.8); (pH 8.6—10.2); (pH 10—11.6) and accessories.

TAYLOR BOILER WATER COMPARATOR

Makes Determinations Fast and Easy



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Apropos of—

Magazine Preference

INCIDENTS like the following, which appeared in the *Los Angeles Examiner*, seldom are recorded. However, thousands of preferences are determined in just this manner. Here's the incident:

A woman bought a car after visiting eight showrooms. Later she was asked how she finally decided which car to buy. She said: "I walked into the showroom with a sore finger which was bandaged, and this salesman was the only one who asked me about it and seemed sympathetic."

You prefer magazine "A" over magazine "B" because magazine "A", like the salesman above, is more interested, editorially, in your particular problems, is more in harmony with the scope of your responsibilities, and is more active in giving you real, basic assistance with your particular job.

Your stamp of "OKAY" on a magazine doesn't just happen. It has to be earned by the magazine. It has to result from a lot of planning and careful adherence to a sound publishing policy. Your approval and preference for INDUSTRY AND POWER is of prime importance to us. For all of our thirty years, we've screened each article in INDUSTRY AND POWER to make sure it fits your needs. And by *you* we mean each man in the Plant Engineering Group in America's busiest and best plants. We also include selected distributors and jobbers, engineers in important contracting organizations, and consulting engineers who work with you executives and engineers who comprise our target readers—the Plant Engineering Group.

For a moment, think of the magazine you seldom or never read even though it is routed to you regularly. That magazine may contain one or even two articles of value to you. However, its editorial content is so broad and has been spread so thin in an effort to interest more and more readers on every level of control and in every department of your plant that it has lost its preference standing with you. It's no longer *your* magazine. It's everybody's magazine to the point where nobody reads it.

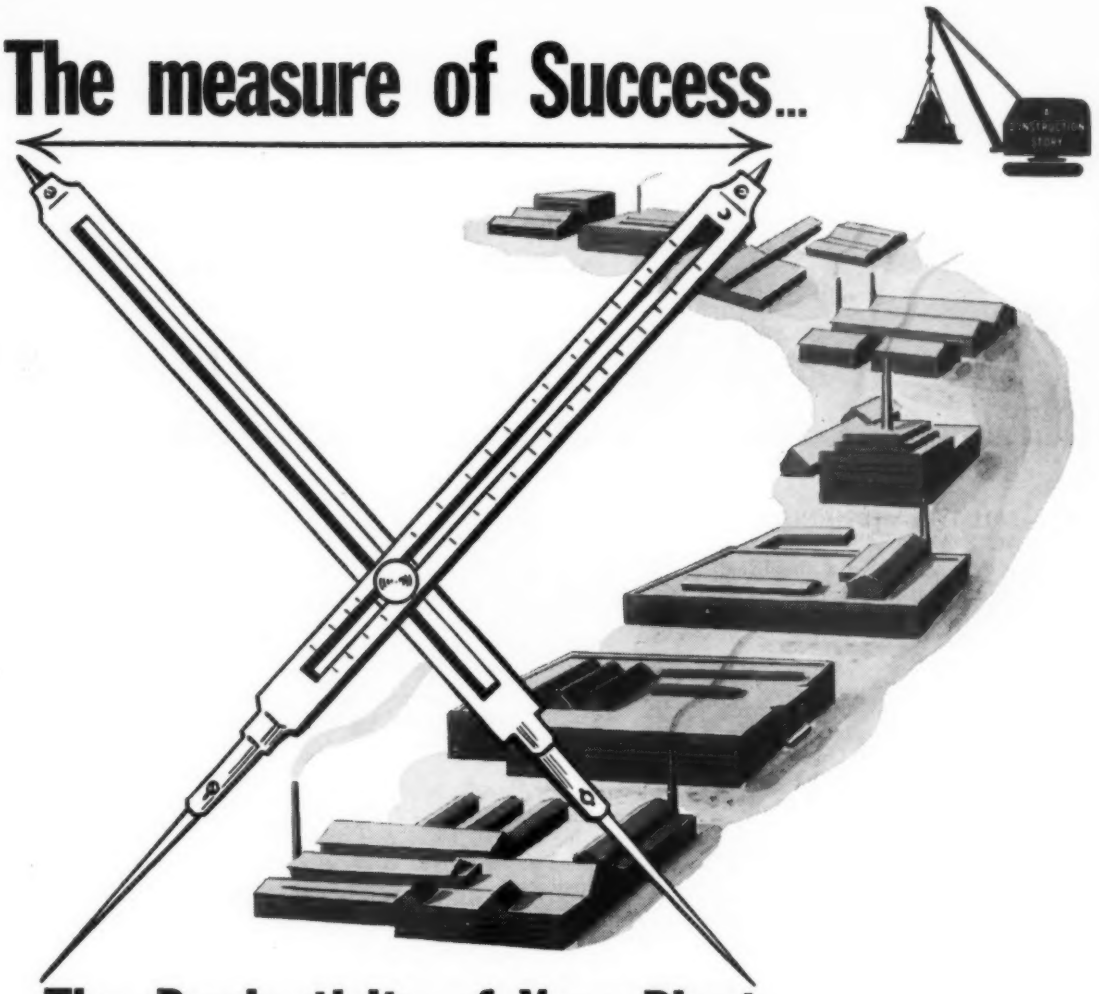
This matter of losing effectiveness through lack of concentrated force has been illustrated dramatically by military maneuvers in World War II. There was some strategic action in the Aleutians, for example, which caused the Japanese to spread themselves so thin that defeat was inevitable. After the attack at Pearl Harbor, the Alaskan Defense Command was formed and two secret airfields were hastily constructed—one at Cold Bay, Alaska and one on the island of Umnak. For these two bases, only two squadrons of fighter aircraft (P-40's) and a few obsolete bombers were available. These troops had been in position only about two weeks when they were able to intercept a Japanese attack and bring down several planes. American troops cashed in on this surprise, and, with aircraft and men too few to hold even the smallest base, a vigorous, concentrated attack was begun. With the shift to defense, the Japanese troops were distributed too thinly over their wide-spread island bases and became ineffective.

Your interest in I&P will never be weakened by a comparable thinning of editorial direction. You'll always find every issue filled with basic, usable, interesting data.

M. J. Sanders

Exec. Vice President

The measure of Success...



The Productivity of Your Plant

Do you agree that the success of your company is directly proportional to the productivity (quantity and quality) of your plant?—We do too and like to cite the case of a manufacturer whose sales three years ago had fallen off sharply and who was squarely faced with the need for an improved product and more of 'em—at less cost per unit. He called in F. H. McGraw & Company. McGraw engineers, working with the firm's chief engineer and plant superintendent, made a plant study from which stemmed many new and illuminating ideas.

McGraw recommendations were harnessed to manufacturer's needs and a blueprint for modernization was drawn up—replacement and relocation of several machines, new equipment and handling systems, revamped electrical and piping systems, an additional building—and work soon got underway. Today the manufacturer's product is a leader on the market and in a relatively short time the construction program will have paid for itself.

If you are contemplating construction of a new plant or modernizing an old one, your first thought is probably: what new facilities will best produce a better product at less cost per unit—Right? If this is your problem, call in an engineering and construction firm that has specialized for 20 years in the building and overhauling of both large and small factories for America's leading industrial firms . . . let our engineers help you solve your construction problems—***IT'S TIME TO MODERNIZE!***

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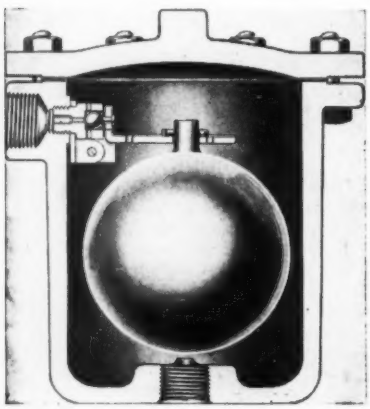
NEW EQUIPMENT & DEVELOPMENTS

For Additional Information Concerning These Latest Developments in Power and Plant Equipment, Applications, Materials, Method and Processes Use One of the Convenient Reply Cards on Page 71. Circle the Numbers of Items in Which You Are Interested.

301—BALL-TYPE MECHANISM ACTS AS SEPARATOR

Crane Co., employing a simplified ball-type seating mechanism instead of the customary disk, has improved its automatic vent and drain valve to assure more accurate seating and longer life. Easy to install in water or oil systems, the valve removes entrapped air, or in compressed air systems removes water and oil. Operation is fully automatic. The cycle of filling and emptying keeps repeating with each accumulation.

Complete range of sizes is available to take care of all air requirements



up to 150 psi and water up to 125 psi. Body and cap of the valve are cast iron and the float is copper. The ball seat is Exelloy, and the ball is of hardened stainless steel.

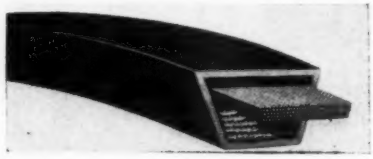
302—DUAL-FUEL BURNER NOW SHIPPED COMPLETE

Two sizes have been added to the recently announced line of North American Series 225 dual-fuel burners and various improvements in design have been made. The units are combination gas-oil burners—especially designed for forging, heat treating, smelting, kiln and drier firing—adaptable for light or heavy fuel oils and low pressure air as well as gas of any Btu content.

Burners are now available in 1, 1¼, 2 and 3 in. sizes. One major improvement is the new refractory tile which has been redesigned to give greater stability to the flame without the danger of carbon formations. The tile is shipped from the factory cemented and bolted to the tile mounting plate. This procedure not only simplifies installation but also prevents separation between the tile and mounting during operation that could cause air leakage around the setting. The North American Mfg. Co.

303—CAPACITY INCREASED 40% IN SYNTHETIC CORD V-BELT

A line of super-rated V-belts, named "HY-T", incorporating a chemically produced fibre of extremely high-strength, low-stretch and excellent shock-absorbing qualities, has been developed by the Goodyear Tire & Rubber Co. This synthetic cord is also water and mildew resistant. The great fibre strength enables handling 40% more hp than standard multi V-belts without excessive stretch.



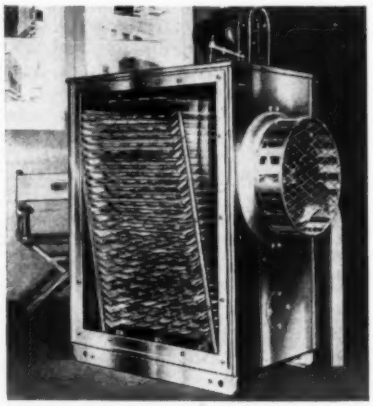
Inherent resistance to shrinking is another advantage of this fibre that gives the belt greater length stability than belts manufactured by the company prior to the development of the revolutionary cord.

The other materials, which form the outside covering of the HY-T, have been treated with a mildew inhibiting agent, thus assuring maximum protection from this malignant growth.

304—PACKAGE COOLING TOWER RUBBER LINED

The Marley Co., Inc., manufacturers of water cooling towers, nozzles, and coolers, has announced an additional size, plus improvements on all Aquatower models.

Towers will be lined with a thick coating of rubber to make the interior impervious to corrosion. A quiet, deep



pitch fan operates at one-half the usual speed. The rubber lining plus the slow-speed fan gives unusually quiet operation.

(Continued on page 10)

Almost

ISN'T GOOD ENOUGH!

Especially when you're buying a water conditioning service!

Sound engineering ability is easier to claim than it is to prove. In fact, the phrase has been used so indiscriminately that it has lost much of its true significance. But here at BETZ, we have never lost sight of its real meaning.

Sound engineering ability has always meant "*completely outstanding performance*" in the water conditioning service bearing our name. There is over two decades of continuity in our efforts to offer a nationwide water conditioning service that is scientifically correct—designed to help you cut plant operating costs. May we show you how and why?
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BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

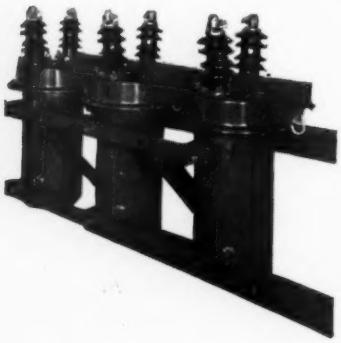
(Continued from page 8)

Units are a packaged product, completely assembled, ready to go. Sized from 3 to 50 tons, they still have the open distribution basin, redwood filling from top to bottom, totally enclosed motors and complete basin fixtures.

305—RECLOSER HAS 100 AMP RATING

Three phase automatic recloser, designated Type FR-3, with maximum service ratings of 100 amp, 15,000 v, has been announced by General Electric Co. The unit extends the advantages of the G-E type Fr-1 single phase recloser to three phase operation and has a short circuit interrupting capacity of 3000 amp.

This automatic recloser is said to be safer operating and easier to maintain. Its simple construction combines three Fr-1 single-phase reclosers in a single unit. Hazard of burning out three-phase loads by having only one-phase lock-out is eliminated. A common linkage assures positive operation in locking out all three phases whenever



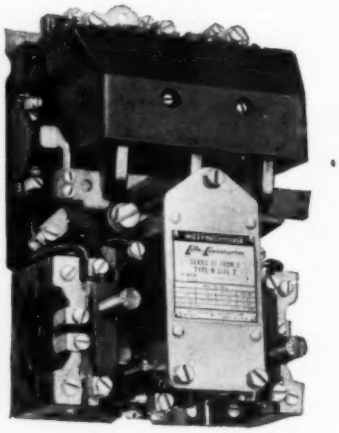
a permanent fault occurs. When the fault is cleared, a single resetting operation closes all three circuits. The three units operate as single-phase reclosers, however, whenever an intermittent fault occurs.

306—MAGNETIC STARTER HAS ONE MOVING PART

A-c magnetic, non-reversing De-ion Life-Linestarter is available from the Westinghouse Electric Corp. Designed for either across-the-line starting of squirrel cage induction motors, or as a primary switch for wound rotor induction motors, this starter provides complete protection of motor, machine and operator.

Only one moving part has been incorporated—a "see-saw" lever balanced on a knife-edge bearing or center fulcrum. It cannot jam or stick, and a positive-action kick-out spring insures uniform operation.

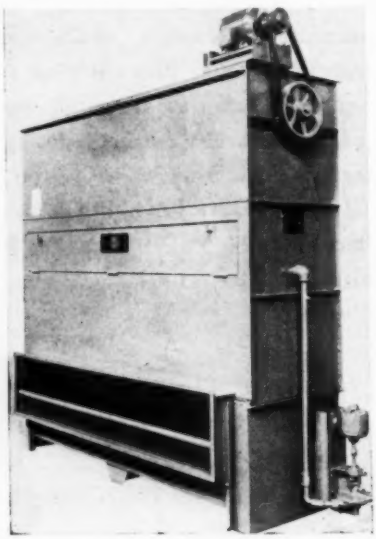
Available in NEMA sizes 0 through 4, it can be applied to all integral motors up to 100 hp. It is supplied in standard a-c voltage ratings from 110



to 600 volts at frequencies of 60, 50, and 25 cycles for three-phase, two-phase four wire, and single-phase operation.

307—FREON CONDENSER SAVES WATER

Aeropass refrigerant gas condenser has been announced by the Niagara Blower Co. Designated as the 5800 series, this condenser is designed especially for Freon refrigerant and for air-conditioning and industrial refrigerating applications. The series consists of five standard units ranging in capacity from 10 to 50 tons refrigeration at 105 F Freon condensing temperature and 74 F atmospheric wet-bulb temperature. The smallest unit



has casing dimensions of 31 x 24 x 85¼ in. in height; the largest is 94 x 30 x 93¼ in. in height. Casing, fan and eliminator construction is galvanized steel. Condensing coils for Freon are copper tube with copper fin or hot galvanized steel tube and fin. Weatherproof construction for outdoor installation is available. Operating on the evaporative principle, the condenser saves 95% of the condensing water required by the shell and tube condenser method; since it replaces both conventional condenser and cooling tower, its first cost as well as operating cost is low.

308—SAFETY FEATURES IN MOBILE STEP LADDER

Mobile step ladder produced by The Ballymore Co. incorporates an automatic safety feature, durability and low cost. The ladder is mounted on ball bearing castors for easy movement, but when a person steps on the ladder the rubber-tipped legs automatically come in contact with the floor. This action prevents rolling and the possibility of a fall. Stock rooms,

parts storage, filing departments and maintenance crews have proved its practicability.

Safety step ladders—made from aluminum finished steel—come in standard sizes from 1 to 6 steps. The frame is ¾ in. steel tubing, and the non-slip reinforced expanded steel step plates are electrically welded.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

309—VARIABLE PULLEY HAS 4 TO 1 RATIO

To provide infinitely variable speed changes (4 to 1) in the two and three hp range, Gerbing Mfg. Corp., has introduced two additions to their line

(Continued on page 12)

Are you buying *Pieces* of equipment . . .

OR A *Complete* OPERATING DUST CONTROL SYSTEM?

● If you've ever attempted to "roll-your-own" dust control system you recognize the baffled expressions above. Problems such as: what air cleaning devices shall we use . . . how much air will we need . . . how much power is required . . . how shall hoods be designed, are but a few of the many problems encountered in building and installing a dust control system.

That's why plants, large and small, have found it pays in greater operating efficiency to have a dust or fume control system designed and installed by experts. For all three—design, fabrication and installation—call on KIRK & BLUM.

Just one contract, one responsibility for a complete, ready to operate system guaranteed to do the job right! If you need a new system . . . or more capacity in an existing one, call on KIRK & BLUM. They'll gladly prove the efficiency of systems by KIRK & BLUM, specialists in dust and fume control for more than 42 years.

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One Undivided Responsibility . . .

DESIGN.. FABRICATION.. INSTALLATION...

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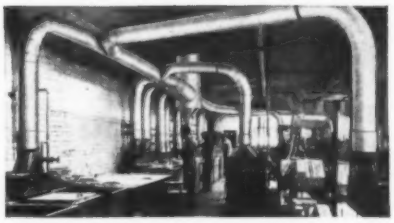
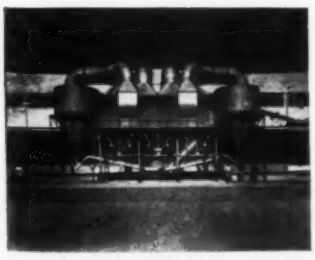
Cincinnati 25, Ohio

Dust control system showing grinding hoods at Crescent Tool Co., Jamestown, N. Y.

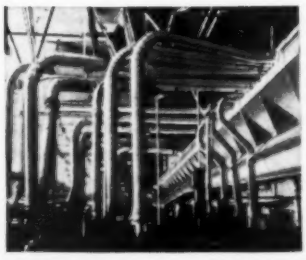


Fume Exhaust System in plating room at S. E. Overton Co., South Haven, Mich.

Down Draft Dust Control System for Grinding and Snagging in machine tool shop.



Dust Control System installed in large woodworking plant.



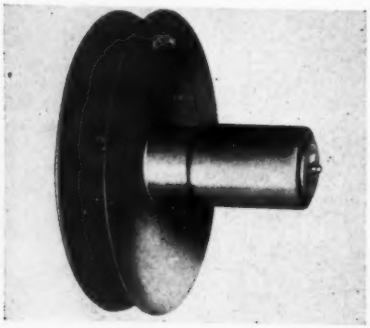
Plenum Type Dust Control System for production woodworking plant.

Dust and Fume Control in modern foundry of famous implement manufacturer.

(Continued from page 10)

of variable pitch pulleys designated as models No. 1050-20 and No. 1050-30.

Designed on sound power transmission principles and utilizing a V to V drive, all variable speed pulleys are dynamically and statically balanced.

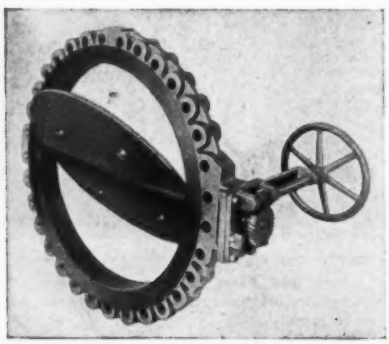


The rack and gear arrangement controls sheave movement and assures perfect belt alignment throughout the entire speed range, resulting in longer belt life. All models are compact, easily installed in either a horizontal or vertical position. No special mounting is required. Available in sizes from 1/8 to 10 hp.

310—WAFER VALVE RESISTS TORQUE

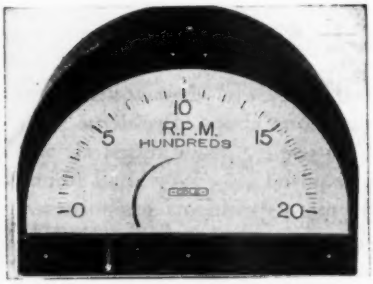
One-piece body casting valves developed by R-S Products Corp. have many of the features of the standard double flanged units. In the open position beveled streamlined vanes create a venturi action. Pressure drop, compared with many other types of valves is low. There are no pockets to capture sediment, no change of flow direction to create turbulence. Freedom from turbulence reduces erosion and cavitation.

These valves, designated as No. 771, are used for air, gas, liquids, steam and semi-solids in the shut-off and regulation of volume and pressure; pressure relief; control of liquid level, back pressure, water hammer, steam hammer, constant differential pressure; regulation of pump, fan, engine and turbine output and control of automatic combustion.



311—SPEED INSTRUMENT HAS SPOTLIGHT POINTER

Large 28¼ in. scale instruments with brilliant spot-of-light pointer, built by Cole Instrument Co., provide readings from a considerable distance easily and accurately. Installed singly in dual or multiple groups, these instruments are adaptable as speed and power indications, dynamometer readings, production testing, monitoring motor loads, reading generator outputs and many other applications where long run circuits are not desirable, yet where distant reading is needed. Can be calibrated to various accuracies from 5% to as close as ¼ of 1% of full scale value. Where extreme accuracy is wanted, the spot-of-light pointer can be provided with a hair-



line, and the scale hand drawn with narrow division lines.

Light beam pointer is produced from a self-contained light source through a precision optical system reflected on a first-surface mirror directly upon the instrument scale. This provides a brilliant elongated spot, which comes to a point directly above the scale division. No additional weight is added to the moving element assembly so there is no drag on the instrument response.

Instruments are 18¼ in. high, 22⅞ in. wide and 7¼ in. deep and weigh 34¾ lb. The instrument is housed in a heavy welded steel case with attractive black wrinkle finish.

312—COOLING WATER TREATED BY POTASSIUM COMPOUNDS

An improved diesel steam generator treatment of superior sludge conditioning qualities and providing greater corrosion protection of coils has been announced by Dearborn Chemical Co. It is a powdered potassium type treatment, rapidly and completely soluble, designed to satisfy all the complex requirements for feedwater conditioning of steam generators by internal methods. It neutralizes dissolved oxygen, reducing corrosion, and improves fluidity of sludge serving to coagulate mud and sludge reaching the steam separator. The amount of sludge recirculated through the generator is thereby reduced.

Silica is converted to soluble form, or removed. Chemical feeding problems are greatly simplified, since it can be applied directly to water storage tanks, automatically by chemical feeders, or in the case of diesel locomotives, using solution tanks and proportioning pumps installed on the units.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

313—GENERATOR CAN BE BELT DRIVEN

Low-priced generator that can be belted to any available power unit or tractor for service in remote areas has recently been announced by Fairbanks, Morse & Co. Generators — furnished in two sizes, 3 and 5 kw — are four-pole, self-excited and designed for operation at 1800 rpm, 60 cycle, 120 v.

A number of features have been incorporated; for example, type HF synthetic enameled wire is used in the winding of both the armature and field coils, and the wires are further impregnated with insulating varnish, oven-baked. All windings are finally covered with Glyptal to make them moisture-proof. The frame of the generator is

of drip-proof construction for service when exposed to the weather.

Two Twistlock receptacles are furnished with the 3-kw units and three with the 5-kw units. A convenient slide rail also makes it possible to adjust the belt tension after the tractor or power unit has been spotted in place.

(Continued on page 14)

Only Ingersoll-Rand's

NEW DIESEL

gives you BIG-ENGINE PERFORMANCE in a small package ...195 to 375 hp

NEVER BEFORE *have these Contradictory Characteristics been combined in one diesel engine*

MOVABLE Can be mounted on welded steel skid base for easy moving.	*but*	**NOT Automotive Type** Built for continuous, full-load operation.
LOW WEIGHT Low transportation, rigging and maintenance costs.	*but*	**Moderate Speed** 900-1000 rpm.
SMALL SIZE Minimum engine room space required.	*but*	**Big-Engine Design** For longer life and more reliable operation.
HIGH FUEL ECONOMY 0.40 lb fuel per hp-hr means sustained low operating costs.	*but*	**Small Pistons** 7" bore x 8½" stroke.
PERFECT BALANCE Minimum concrete foundation required.	*but*	**No Balancing Devices** 6 or 8 cylinder engine with in-line construction.

Until now the only Diesel Engines in the 195 to 375 hp range were either automotive-type units at top limits of speed and rating, or heavy, slow-speed and oversize derated engines. But now with the new Ingersoll-Rand TS Diesel you can get the small size and light weight of an automotive unit—plus the operating economy, stability, and long life of the big engine.

In the TS Diesel you'll find big-engine features like these: Big 5¼" crankshaft ... full-floating, interchangeable aluminum-alloy shells for both main and crankpin bearings ... full pressure lubrication ... individual cylinder heads ... replaceable cylinder liners ... removable valve seat inserts ... single-hole injection nozzles ... gear-driven supercharger ... and many others.

Call any Ingersoll-Rand branch office for complete facts on the new TS Diesel, and you'll see why it has been called the outstanding advance in engine design in the past decade. It is an ideal engine for every type of heavy-duty service.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 530-7

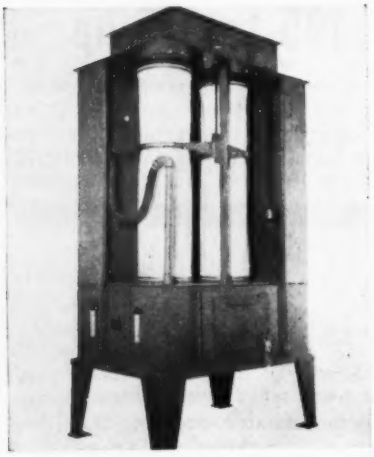
(Continued from page 12)

314—DUST COLLECTOR HAS HIGH EFFICIENCY

Turner & Haws Engineering Co., Inc. has designed a bag-type dust collector which features automatic, continuous cleaning and has a 99.9% dust collecting efficiency. The structure of the collector is 50 to 75% smaller and lighter in weight than previous models handling the same volume. Filtering rate as high as 60 fpm, made possible by felt media, assures years of service before replacement.

High dust collecting efficiency allows greater recovery of fines at higher filtering rates than ever before possible. Dust nuisances are eliminated, and costs for plant and machinery maintenance are reduced.

One feature is the automatic filter

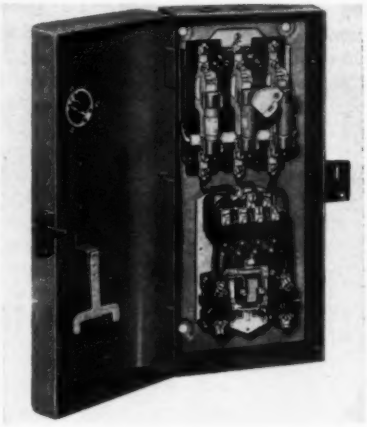


bag cleaning that eliminates manual attention and expensive week-end cleaning labor costs. Space requirements are at a minimum for given air handling capacities. The collectors can be supplied in sizes and arrangements to suit any installation requirements inside or out.

315—MAGNETIC STARTERS MEET NEC STANDARDS

Combination magnetic starters with disconnect switches announced by Ward Leonard Electric Co. are fusible and non-fusible. Adaptable for industrial and commercial use where a magnetic full voltage starter coupled with disconnect means at starter location is preferred over separately mounted components.

Starters with fusible disconnect switches fulfill NEC requirements for motor branch circuit over-current protection, disconnecting means, motor running over-current protection and motor starter. Non-fusible starters meet these same requirements except for motor branch circuit protection. Components conveniently arranged in NEMA Type 1 general purpose enclosures are internally pre-wired and completely accessible.



Starters have the following features: front operation, maximum safety, simplified installation, thermal overload protection, high arc interruption capacity, provision for padlocking in "ON" and "OFF" position and interlock protection in "ON" position. Available in four standard sizes to 50 hp, 3 phase, 550 v, 60 cycle. Standard operating coils can be supplied for 110, 220, 440 and 550 v service on frequencies of 25, 50 or 60 cycles.

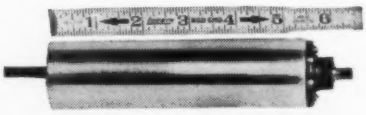
316—PACKING FITS INTO ANY SHAPE AND SIZE

Self-forming, self lubricating, stringless packing—which forms itself into the exact size and shape of any fitting or pump stuffing box into which it is placed—has been developed by the Packing Div. of Flexrock Co.

Marketed under the name Steamfitters' Special Packing this product will be furnished in rope form 1/8 in. in dia. Extensive and independent tests indicate that the packing can be used on rotating and reciprocating rods, shafts, stems, also, on joints handling air, gas; hot, cold or salt water; steam (up to 150 psi); oils, most acids, alkalies and solvents; ammonia, brine and other refrigerants.

317—SERVO-MECHANISM IN SIMPLE HOUSING

Unit for use in velocity-servos and motor integrator systems consists of



a permanent magnet field type 27.5 v armature d-c motor to whose high speed shaft (10,000 rpm max) has been coupled a permanent magnet field type d-c rate generator. A 250 rpm max low speed output shaft is coupled to the motor through suitable gear reductions. This unit is housed in a 1½ in. dia 6 in. long aluminum tube for incorporating into velocity-servo systems or motor integrator systems using d-c control amplifiers. This unit may also be incorporated into position type servo systems using the motor coupled to a separate followup device and the tachometer for error rate stabilization.

Torque unit motor supplies an output torque of approximately 6 in. oz and the tachometer output is available in various models at from 2 v per 1000 rpm of motor speed to over 10 v per 1000 rpm. Special models are available to your specification. Servo-Tek Products Co.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

318—POWER CORD HAS PLASTIC INSULATION

Refrigeration power supply cords are easier and less costly to make with Vinylite plastic electrical insulating compound which can be applied in a single extrusion according to Bakelite Div., Union Carbide and Carbon Corp. Requiring no fillers and no braid, the power supply cord (upper) is heavier

than the conventional Vinylite plastic insulated lamp cord (center), but simpler and less costly in construction

(Continued on page 16)

fedders

Announces NEW WALL RADIATION

fedders
A Great Name Since 1896

● *Fedders Wall Radiation* provides new lower costs...easier and greater space-saving installations...lighter weight... easier handling...easier stocking.

TYPE EM ENCLOSURE
fabricated from expanded metal.

TYPE FT ENCLOSURE
having flat top with die-cut grille.

TYPE ST ENCLOSURE
having sloping top with die-formed louvered grille.

Increased efficiency of transferring heat is assured by the pattern stamped in the fins which creates a turbulent scrubbing action of airflow against fins. This die-formed pattern also produces greater fin strength.

Three styles of enclosures are available as illustrated.

Fedders Wall Radiation for steam and hot water lines is available in lengths from 2 to 12 feet in 6 inch increments. 38 and 50 fins per foot on 1¼ inch tube and 24 fins per foot on 2 inch tubes. Write for catalog WR-C1 TODAY.

FEDDERS-QUIGAN CORPORATION
BUFFALO 7, N. Y.

Quigan

(Continued from page 14)

than the standard SJT type refrigeration supply cord (lower). Tested by Underwriters' Laboratories and listed as suitable for supplying power to electric refrigeration assemblies where type SJ flexible cord has been accepted. The cord consists of two No. 18 or 16 stranded conductors laid in parallel and covered with the special plastic insulating compound, providing an integral insulation and jacket with nominal thickness of 4/64 in. and nominal separation between conductors of 7/64 in.

In tests, the cord withstood five times the required slow-compression weight without short circuiting. In the test requiring no failure from the impact of a 5-lb weight dropped from a height of 4 ft, the cord did not fail in flat position when the weight was dropped from 9 ft, nor in edgewise position when it was dropped 5 ft.

319—LIFT TRUCK COMES IN 5, 7½ AND 10-TON CAPACITY

Silent Hoist and Crane Co., manufacturers of mobile cranes and fork lift trucks, have available lift trucks in sizes 5, 7½ and 10 ton capacities. Dual pneumatic traction tires are mounted on a "dead" axle, which supports the chassis and fork load, relieving the differential drive from this severe service.

Lifting and tilting hydraulic units are oversize, operating at moderately low fluid pressure. Lifting guides are interlocked with each other to provide

perfect alignment and equal distribution of the fork loads. Improved vision for the operator has been accomplished. Liberal ground clearance has been provided, making it possible to operate under adverse terrain conditions. Various attachments, such as shovels, special forks and fork extensions, power spreaders, rotary aprons for forks and special winches and crane booms are available.

320—RESISTANCE HEATING SOLDERING TOOL

Ideal Industries, Inc. has announced a 1,000-watt economy model soldering tool that operates on the resistance heating principle. This portable unit does the job quicker, safer and easier, eliminating fire hazards and discolored work.

Touching the work with the tool completes the secondary power circuit, and heating begins instantly—there is no pre-heating, no waiting. Current is drawn only when in contact with the work.

Concentration at the point of contact results in heating only the part to be soldered. A better, stronger joint is made because of faster and more even heating. Danger of melting nearby joints is minimized.

Attachments available for handling all types of work include: plier attachment for sweating and unsweating copper tubing, soldering lugs, terminals and other work of that type; fork attachment with two 3-in. electrodes for reaching into restricted places such as

switch boxes, electrical tools and equipment; and pencil attachment with one 3-in. electrode for spot soldering and light seam soldering.

321—CONTROLLER REGULATES TEMPERATURE, FLOW AND SPEED

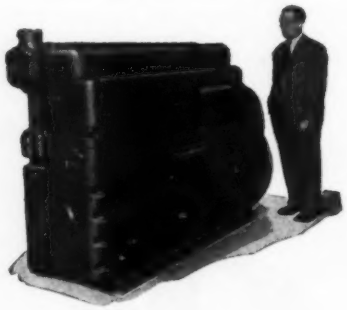
Pneumatic current controller (Model "EB") has been developed by Conoflow Corp. primarily to permit the use of standard industrial pneumatic controllers on applications involving electrical components as the final controlled element. Assemblies are adaptable for the ultimate control of temperature, flow, speed and pH. Principal utilization is temperature control of electric furnaces and drying ovens, temperature control on electrically heated stills and columns in pilot plants and laboratories. It also can be employed in conjunction with a small rheostat-potentiometer for controlling the input to electronic speed control devices. Controller utilizes a standard electrical component modified for continuous throttling

control service. A pneumatic cylinder operator includes an integrally mounted positioning device to provide accuracy and sensitivity of positioning to within 1/500 part of its total travel.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

322—COMPACT DIESEL WEIGHS 30 LB PER HP

Diesel engines in the 195-375 hp range have been announced by the Ingersoll-Rand Co. Designated as the TS diesel, this engine incorporates many new design features which have resulted in a previously unattainable combination of characteristics. It is a four-cycle, 7-in. bore, 8½-in. stroke, single-acting engine with a weight of

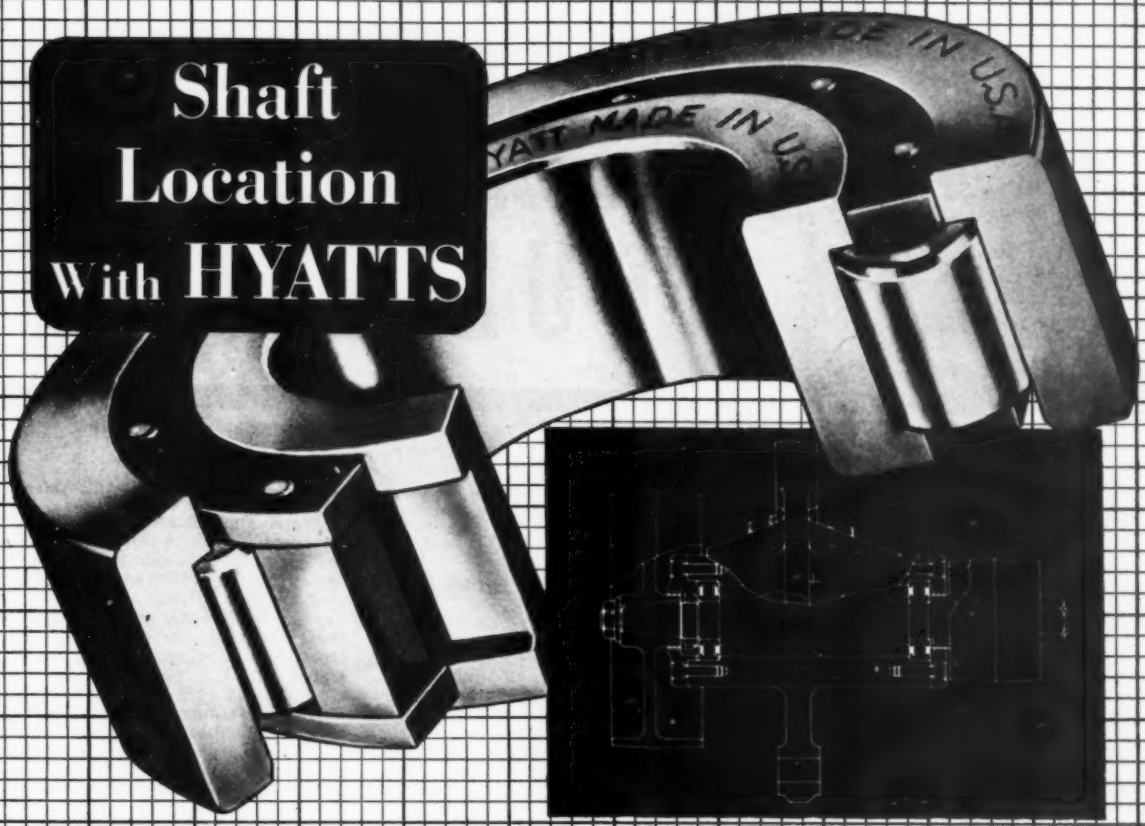


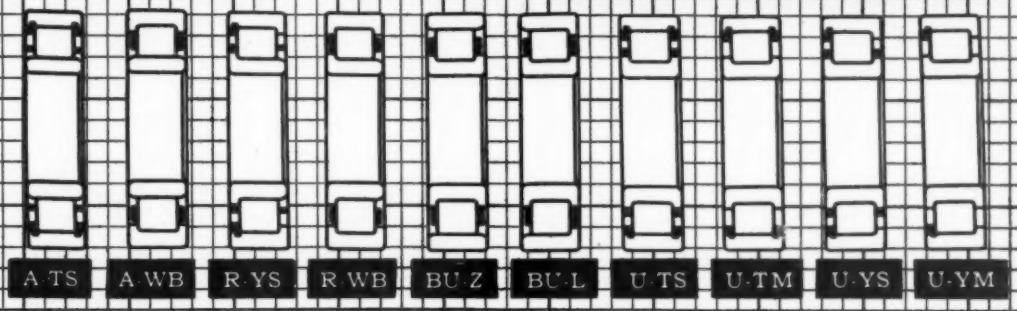
about 30 lb per hp and a fuel consumption of 0.40 lb per hphr.

Cylinders are provided with replaceable, wet-type liners and individual heads with overhead valves and intake and exhaust valve-seat inserts. The thick-wall, long-skirt pistons are of aluminum alloy, with ventilated oil-scraper rings above and below the full-

(Continued on page 134)

Shaft Location With HYATTS





HERE is one of the ten basic types of Hyatt Hy-Load Cylindrical Roller Bearings, the "B-UL". It provides not only the high load capacity and long life of a cylindrical roller bearing but shaft location as well. It may be used on any application where two bearings are mounted opposed to locate shafts or gears in both directions.

The "B-UL" application illustrated is just one of the many ways in which the Hyatt Hy-Load Series Bearings can be used. Each of the ten different types of Hy-Loads have their special purposes and applications. Full information about all ten types of Hyatt Hy-Loads is in our catalog 547 . . . a complete engineering guide to radial bearing selection and use.

. . .

Write now for your copy. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

NEW BULLETINS

Copies of the listed booklets, which are the very latest published by leading equipment manufacturers, may be obtained by using the convenient postage-free cards on page 71. Circle the letter corresponding to the one shown in the item.

BOILERS, AUXILIARIES, ACCESSORIES

Heat Transfer (A) House organ outlines the many different types of heat transfer apparatus manufactured by this company for power plants. Descriptions and illustrations cover boiler feedwater evaporators and heaters, oil and water coolers, heaters for fuel oil and storage tanks, and generator air coolers. The Griscom-Russell Co.

Oil Heaters (B) Bulletin contains specifications and descriptions of medium sized oil heaters in capacity ranges between 120 to 1800 gph. The oil temperature—heated by steam—is raised to 80-100 F above the entering condition. Features of the compact unit are clearly stated. Leyman Mfg. Corp., McGowan Pump Div.

Technical Data (C) Technical data on electric resistance welded steel boiler tubes has been made available. For convenience in ordering, tables are furnished on maximum allowable working pressures for different diameters and gages of tubes for water and fire tube boilers. Another table determines the weight in lb per lineal ft of steel tubes in various minimum wall sizes. Babcock & Wilcox Tube Co.

Instruction Chart (D) Four-page folder contains a two page spread chart to show plant engineers how to determine the proper size of continuous blowdown for an installation. The remaining two pages cover instructions on how to use the chart and select equipment. Henszey Co.

Steam Jet Deaerator (E) Informative eight-page folder covers all pertinent details on construction and specifications of a steam jet deaerator. Cutaway views illustrate the principles of operation clearly. A typical performance chart shows the amount of oxygen dissolved at various loads. Worthington Pump & Machinery Corp.

Fluid Coolers (F) Technical data on water, oil and liquid coolers selection are covered in a well prepared bulletin. Design formulae are simplified so after substituting table and chart values only slide rule computations are necessary. Tables and charts are included to make possible any type of selection. Of particular interest are the cross sectional drawings and explanations of floating heads and tube bundles. Condenser Service & Engineering Co., Inc.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Steam Turbine (G) Single stage steam turbine, for high pressure application, is illustrated and thoroughly explained in a colorful four-page bulletin. Specifications and composition of materials are listed for three sizes—600, 1,200, and 2,000 bhp. The DeLaval Steam Turbine Co.

Engine Air Filters (H) Two bulletins (No. 120D and 150A) contain application and selection data on air filters and their metal holders for air compressor, diesel and gas engine air intake service. Outline dimension sheets and specifications are included. American Air Filter Co., Inc.

Engine Intake Silencer (I) Bulletin, designated as No. 130-E, contains information on nine sizes of an oil bath air cleaner and intake silencer for combustion engines and air compressors. Operational features are explained—both with text material and cross-sectional flow diagrams. Capacity, selection and dimension tables are listed. American Air Filter Co., Inc.

Air Compressors (J) Colorful 18-page bulletin contains numerous photographs of featured items of this company's two stage air compressor. Cross sectional views show the air flow in color. The lubrication system specifications and dimensions are covered for three sizes: 7 in. stroke, 125 to 150 hp; 8½ in. stroke, 200 to 250 hp; and 10 in. stroke 300 to 350 hp. Discharge pressure ranges between 80 to 125 psi. Ingersoll-Rand Co.

Portable Air Compressor (K) Folder covers all features of a compact portable air compressor. Cross sectional drawings are captioned, with colored arrows leading to important parts of the compressor. Specifications are listed for the compressor and engine, with table on number of tools operated. Accessories and their application are included. Worthington Pump & Machinery Corp.

WATER AND LIQUID TREATMENT

Water Purification (L) Revised 16-page bulletin gives complete engineering data, specifications and capacity tables for three types of circular collectors for the clarification of sewage, industrial waste water and water purification. Featured components of the system are thoroughly explained and illustrated. Ralph B. Carter Co.

Water Hardness Test (M) New literature describes method for determining water hardness. The precision and range of adaptability extend from softened waters with less than 1 ppm of total hardness to those having concentrations comparable to sea water. Only the hardness indicator, a standard acetate solution (N/50) and a buffer solution are required to make the test. Allis-Chalmers Mfg. Co.

Water Conditioner (N) Descriptive four-page report tells how a chemical conditioner will "make water wetter" so it penetrates hard-to-dissolve materials. Many applications are covered. Removal of such items as oil, glue, resinous deposits, grease, slime, algae and grime is explained. Service Industries.

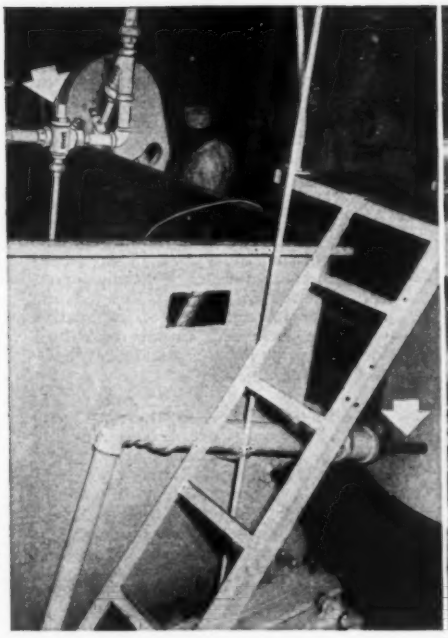
Evaporation Losses (O) Report entitled "Evaporation Losses from Cone Roof Tanks" offers data that will help engineers solve problems involving liquid storage. Three main topics are covered: evaporation losses, breathing losses, and filling losses. Graver Tank & Mfg. Co., Inc.

Hot Process Softener (P) Comprehensive illustrated bulletin on the most recent developments in hot-process water softeners contains introductory section that concisely explains boiler plant troubles caused by various impurities in water. Twelve different methods are outlined for treating water to eliminate impurities. Two basic designs and their operation are fully described together with six adaptations of each design to various plant conditions. Graver Water Conditioning Co., Div. of Graver Tank & Mfg. Co., Inc.

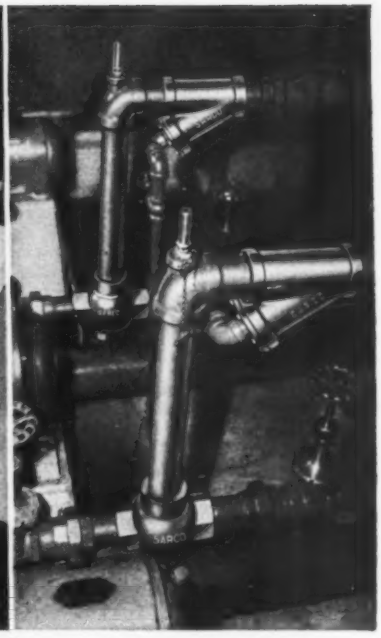
Water Cooling (Q) Specification and engineering data for a compact water

(Continued on page 20)

THE COST OF COLD



Sarco TR-21 on can cooling



Sarco Blenders on Diesel engines

It's human to play safe and "open her up wide" when cooling is done by hand control. But what is the cost of too much cold and more cooling water than you need?

In Process Cooling

The cooling hook up above handles forty No. 10 tins of syrups or foods per minute. It's a conveyor job with temperatures critical above sixty degrees. Formerly wide open, for safety, Sarco now opens or closes the valves down to a trickle as needed. Production is uninterrupted and absolutely uniform. Catalog No. 700.

In Refrigeration

Too much cold can be very expensive. For instance, it costs 15% more to cool milk to 37° than to 40°. Brine can be recirculated by the Sarco Blender shown at the right. No waste cold. Also ideal for defrosting, or any cooling operation. Catalog No. 700.

In Engines and Compressors

There is only one temperature of jacket water that will insure against overheating and give highest operating efficiency. At least ⅔ of the metered water was saved on a battery of compressors in Chicago by using Sarco, instead of wide open, "play it safe," hand control. Also water in hot well is now suitable for process work because its temperature is more uniform.

ASK FOR SARCO CATALOG No. 700 ON COOLING CONTROLS

This is the self contained, self acting control used for steam, water, brine and gas valves. No packing — no stuffing boxes. Pressures to 175 psi. Catalog No. 600.
SARCO BLENDER
A three way mixing valve that delivers liquids at constant temperatures regardless of pressures and temperatures in hot and cold supply lines. Catalog Nos. 700 and 800.

257

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

(Continued from page 18)

cooling tower are covered in colorful bulletin. Construction details are clearly explained. Dimensions and rating tables are included for each of the 8 sizes available. The Marley Co., Inc.

ELECTRICAL EQUIPMENT

D-c Motors (R) Bulletin, that contains four pages, covers d-c motors rated at 250 to 6000 hp, for high and low speed and for direct, belt, or gear drive. Construction features are illustrated and discussed. A page is devoted to mechanical modifications, such as enclosed models and low-inertia mill type motors. Elliott Co.

Circuit Transformers (S) A handy ordering table is included in a four-page folder on power circuit transformers. Transformers from 50 to 15,000 va capacity are conveniently cataloged. A typical wiring diagram showing the use of higher voltage circuits is also included. Jefferson Electric Co.

Rectifiers (T) Two catalogs, just released, contain information on oil-immersed and air-cooled cathodic protection rectifiers. Construction and operating features are listed for both types of unit. Units can be connected in parallel, series and series-parallel. Good-All Electric Mfg. Co.

Electrical Maintenance (U) Booklet entitled "Care of A-C Rotating Equipment" is broken down into preventive maintenance and machine repairs. Such subjects as drying moist insulation, measuring insulation resistance, bearing clearances and proper machine applications are covered. Machine repair section includes information on stator coil and slip ring rotor repairs and balancing of rotating equipment. Allis-Chalmers Mfg. Co.

D-c Generators (V) Bulletin describes an expanded line of d-c generators for lighting and power services. Specifications and featured construction specialties are included for all sizes from 10 to 1500 kw. The Electric Products Co.

Distribution Transformer (W) Distribution transformer, completely self-protected to insure fewer outages and lower operating expenses, is described in a new 8-page bulletin. Mechanical data and the five type designations of the transformer are given, along with a typical load-time curve for one of the units. The transformers are available in ratings of 3 kva through 100 kva—2,400 to 14,400 volts. Allis-Chalmers Mfg. Co.

Synchronous Motors (X) Eight-page, two-color bulletin on low-speed synchronous motors—designated as publication GEA-5332—illustrates typical installations of high-power-factor, constant-speed drives. Construction features are explained, and mechanical modifications and performance data are indicated. Type TS (3 phase) and Type QS (2 phase) motors in the "6000 series" and ratings from 20 to 15,000 hp are covered. General Electric Co.

Oil Circuit Breakers (Y) Moderate capacity oil circuit breakers of quick-clearing, non-oil-throwing design for outdoor distribution service, where reliable and safe operation is required without frequent adjustment or inspection, are described in a four-page bulletin. Specifications and outline dimensions are shown for three sizes that range from 23.0 kv to 250,000 kva interrupting capacity. Allis-Chalmers Mfg. Co.

INSTRUMENTS, CONTROLS, RECORDERS

Cabinet Instruments (Z) Bulletin describes a cabinet series of auxiliary control devices. Each unit is briefed and illustrated for the type of application for which it is best suited. Specifications and price list are included. Wheelco Instruments Co.

Watthour Meter Evaluator (AA) Evaluator is an aid in determining the economic point to retire older watthour meters. It is fully described and answers the question "when is it economical to retire a group of meters?" Resembling a circular slide rule, the evaluator has scales for such factors as cost of new meters, age of old meters, and excess annual cost of old meters over new meters. General Electric Co.

Gas Analyzer (BB) Two four-page bulletins contain helpful information on gas analyzing and a U-path steam calorimeter. Descriptions are given for both items on application, specifications and theory. Ellison Draft Gage Co., Inc.

MATERIAL HANDLING

Flyash Collectors (CC) Attractive eight-page folder contains engineering data, construction details, general dimension table and capacity chart. Typical flow diagram chart indicates how this unit collector is to be installed, and views with cutaways illustrate the ash collecting principal. Buell Engineering Co., Inc.

Vibrating Feeders (DD) Liberally illustrated 16-page bulletin shows this company's line of vibrating feeders and flow equipment. Descriptions accompany each photograph or drawing so a clear picture of the operation and features is obtained. Syntron Co.

POWER TRANSMISSION

Torque Couplings (EE) Two bulletins just released cover information on a line of thrust and floating shaft couplings. One bulletin contains general descriptive material while the other gives pertinent details on method of selection, dimensions and engineering data. The Falk Corp.

Roller Chains (FF) Attractive 16-page catalog covers a complete line of finished steel roller chains manufactured by this company. Specifications and engineering data are included for single, double, triple and quadruple widths. Also illustrated and described are silent chains and sprockets. The Union Chain and Mfg. Co.

PUMPS AND ACCESSORIES

Air Powered Pumps (GG) Pictorial 16-page bulletin covers all applications of an air-operated, controlled volume pump. Design details and advantages are illustrated and explained. Flow diagrams, utilizing this pump, are shown for several types of installation. Milton Roy Co.

Two Stage Pump (HH) Features of three, two stage, double suction centrifugal pumps are illustrated and described in detail. Dimensional data and selection chart are included. These pumps operate at 400 to 1300 ft head. Worthington Pump and Machinery Corp.

Centrifugal Pumps (II) Four-page flier describes a line of cradle-mounted centrifugal pumps. A sectional view of the pump is shown with all of its salient features pointed out and described. In addition, the various types of drives are illustrated. Ingersoll-Rand Co.

Positive Volume Pumps (JJ) Rotary and centrifugal positive blowers and exhausters in single and multiple stages are illustrated and thoroughly discussed in a four page bulletin. Features of each pump are explained, and typical applications are suggested. Roots-Connersville Blower Corp.

Self-priming Pump (KK) Unique construction details of this self-priming, centrifugal pump are explained in a four-page multi color bulletin. Cutaway view, captioned with leads to the important parts, gives a clear picture of all working parts. Dimensional chart is listed for 3500 rpm, 1½ to 10 hp sizes. Allis-Chalmers Mfg. Co.

Vertical Centrifugal Pump (LL) Colorful bulletin covers all phases pertinent to installation, maintenance and construction features of an encased vertical centrifugal pump. Characteristics such as capacities, heads, drives and construction materials are analyzed. Dimension and selection data are listed. Peerless Pump Div., Food Machinery and Chemical Corp.

Self-Priming Pumps (MM) Catalog on self-priming centrifugal pumps covers specifications, operating characteristics, and engineering data for proper selection. Numerous photographs and illustrations are shown of basic principles and features. Marlow Pumps.

Centrifugal Self-Primers (NN) Brochure of eight pamphlets covers detailed information on a line of self-priming centrifugal pumps that are portable and are mounted on chassis. Features and specifications are listed for each pump and companion engine. Leyman Mfg. Corp., McGowan Pump Div.

Centrifugal Pumps (OO) Three folders are offered that contain information on: long coupled, close coupled, and straight centrifugal pumps. Dimensions and engineering data are included for all sizes in each type of pump. The proper selection can be made for any situation. Marlow Pumps.

TOOLS AND SPECIALTIES

Lapping Procedure (PP) Booklet illustrates and describes a method of flat lapping for extremely close tolerances. Photographs, diagrammatic drawings and complete data provide information for all industries whose manufacturing operations include precision surface flatness and RMS finish. Crane Packing Co.

(Continued on page 145)

STOP RUST!

YOU can STOP RUST . . . PREVENT RUST...on *any* rustable metal surface with RUST-OLEUM. Every day, rust eats away on your metal tanks, buildings, fences, stairs...everything metal inside and outside your plant. Yet, rust *can* be stopped and protection given economically with RUST-OLEUM.

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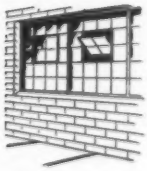


READERS' GUIDE

to equipment advertised and available literature

For your convenience all the literature offered in the advertising of this issue is briefly reviewed in this guide. If you are interested in a particular type of equipment, such as electrical for example, refer to the section "Electrical Equipment", read the advertisements, and select the literature you want. Circle the corresponding numbers on one of the postage-free cards on page 71 and mail. You will receive promptly the additional information you desire.

BOILER & FURNACE CONSTRUCTION UNITS

1—See pages 50, 51. Complete Steam Generating Units: A Riley unit will reduce your investment costs by reducing building height, by eliminating costs of seals between unit and ash hopper, by eliminating cost of separate ash hopper, by reducing maintenance and increasing efficiency, and by lowering costs without sacrifice of operating advantages. Write for complete information. Riley Stoker Corp.

2—See page 70. Packaged Steam Generators: New fully illustrated catalog 202 gives complete details and engineering data for units available in 17 sizes from 20 to 500 bhp to operate at pressures up to 250 psi 80% thermal efficiency guaranteed. Superior Combustion Industries.

3—See page 143. "Economist" Boiler: Gas or oil—hand or stoker. Fully portable. No special foundation needed. High efficiency. Low fuel cost. Write for free catalog. The C. H. Dutton Company.

4—See page 56. Steam-Pak Generator: Efficiency originates with the Iris Shutter that controls the air injected into the burner for proper flame control with either gas or oil. Full details are yours for the asking. York-Shipley, Inc.

5—See page 149. Amesteam Generator: Dependable, quick steaming unit. Minimum installation expense, economical operation. Write for latest bulletin for full description and operational data. Ames Iron Works.

6—See page 134. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

7—See page 147. Packaged Steam Boilers: Write for catalog of complete information on these packaged steam boilers—fully automatic, 60 to 500 horsepower plus ample overload — guaranteed, proved efficiency and capacity. Johnston Brothers, Inc.

8—See page 32. Boilers: Write for free catalog of water and fire tube boilers. Bigelow boilers have been proved for service in major installations both in the United States and in foreign countries. The Bigelow Company.

9—See page 146. Analyzer: For higher combustion efficiency, less fuel loss, this CO_2 Analyzer gives full, sensitive and accurate analyses of boiler flue gases. Write for Bulletin 900. Charles Engelhard, Inc.

10—See page 74. Packaged Steam Generators: Write for your free copy of Bulletin PG-49-13 which contains drawings, sizes, and descriptions of Foster Wheeler Package Steam Generators. Foster Wheeler Corporation.

11—See page 48. Steam Generating Units: Complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels. Outstanding installations point to proved use-satisfaction. Write for complete data and information. Henry Vogt Machine Co.

BOILER FEED WATER

12—See page 154. New Versene Test Kit: Enables you to test the hardness of water in your plant in less than two minutes. As easy as telling red from blue and is accurate to within one grain of hardness per gallon. Packaged in special sturdy pocket-size plastic box. Includes enough chemical to make more than fifty separate tests. Refills available, full directions in each kit. Price is $3.00, postpaid on a money-back basis. The Bersworth Chemical Company.

13—See page 9. Water Conditioning: Write for sound recommendations of Betz' engineers to help you select the water conditioning service best suited for your boiler plant. W. H. & L. D. Betz.

14—See page 59. Feedwater Heaters: See chart on page 59 which shows you how much fuel you save by utilizing residual energy in exhaust steam. In addition to this saving, a Swartwout feed water heater will improve boiler operations — faster; temperature strain relief; removal by deaeration of soluble gases that cause boiler and economizer corrosion. The Swartwout Company.

15—See page 6. Modern pH and Chlorine Control Book: New 96-page data-reference book describes scientific outfits and improved methods to step up boiler efficiency and prevent scale, corrosion, and embrittlement. W. A. Taylor and Co.

16—See page 63. Water Softeners: "Double-Check" line of softeners feature newly designed manifold and high-capacity zeolite. The "Double-Check" Method can also be applied to your present softener for dollar saving advantages and extra capacity. Write for more details. Elgin Softener Corp.

17 — See page 40. Water Conditioning Equipment: Write for full particulars on Graver equipment which includes the Reactivator, zeolite softeners, hot process or lime and soda softeners, demineralizers, and pressure filters. Pass along your individual water problems for dependable answers to Graver Water Conditioning Co.

18—See page 136. Oxygen Corrosion Eliminator: Santosite, maintained in boiler feed water, removes dissolved oxygen and prevents oxygen corrosion. Send for Santosite Bulletin No. O-26. Organic Chemicals Div., Monsanto Chemical Co.

TO GET YOUR FREE COPIES OF THIS NEW LITERATURE CIRCLE THE CORRESPONDING NUMBERS ON ONE OF THE CONVENIENT POST CARDS ON PAGE 71. MAIL A CARD TODAY. NO POSTAGE NECESSARY.

CLEANERS AND BLOWERS

19—See page 151. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. 5 models with attachments for every cleaning job. Write for more data. Clements Mfg. Co.

DIESEL POWER

20—See page 13. Smaller, Lighter, Heavy-Duty Diesel Engine: Ingersoll-Rand TS Diesel available with 6 or 8 in-line cylinders, delivering 195 to 375 continuous hp at 900 to 1000 rpm. Extra stamina and dependability of big-engine design. Write today for more information on the new RS Diesel — or for greater power, ask about the well-known S and SS Diesels up to 900 hp. Ingersoll-Rand.

21—See page 54. Superior Diesels: Be sure to read the remarkable success story on page 54 which can be duplicated for you. A Superior representative will be glad to call and give you personalized help. Or write for your free copy of "Superior Diesel For Stationary Application". The National Supply Company.

22—See page 38. Nordberg Diesels: Built in sizes from 10 hp to 8500 hp, in a wide range of gas and oil burning types. Dependable power at low operating cost. Write for further details, outlining your requirements. Nordberg Mfg. Co.

DUST & FLY ASH COLLECTING EQUIPMENT

23—See page 139. Dust Control: Write for information on how dust control equipment can create better working conditions that result in more production and lower costs. Dracco Corporation.

24—See page 11. Dust Control: Let Kirk & Blum experts design, fabricate and install a complete dust or fume control system for your plant. This service solves your problems for you—pays off in greater operating efficiency. Write for full information. Kirk & Blum Mfg. Co.

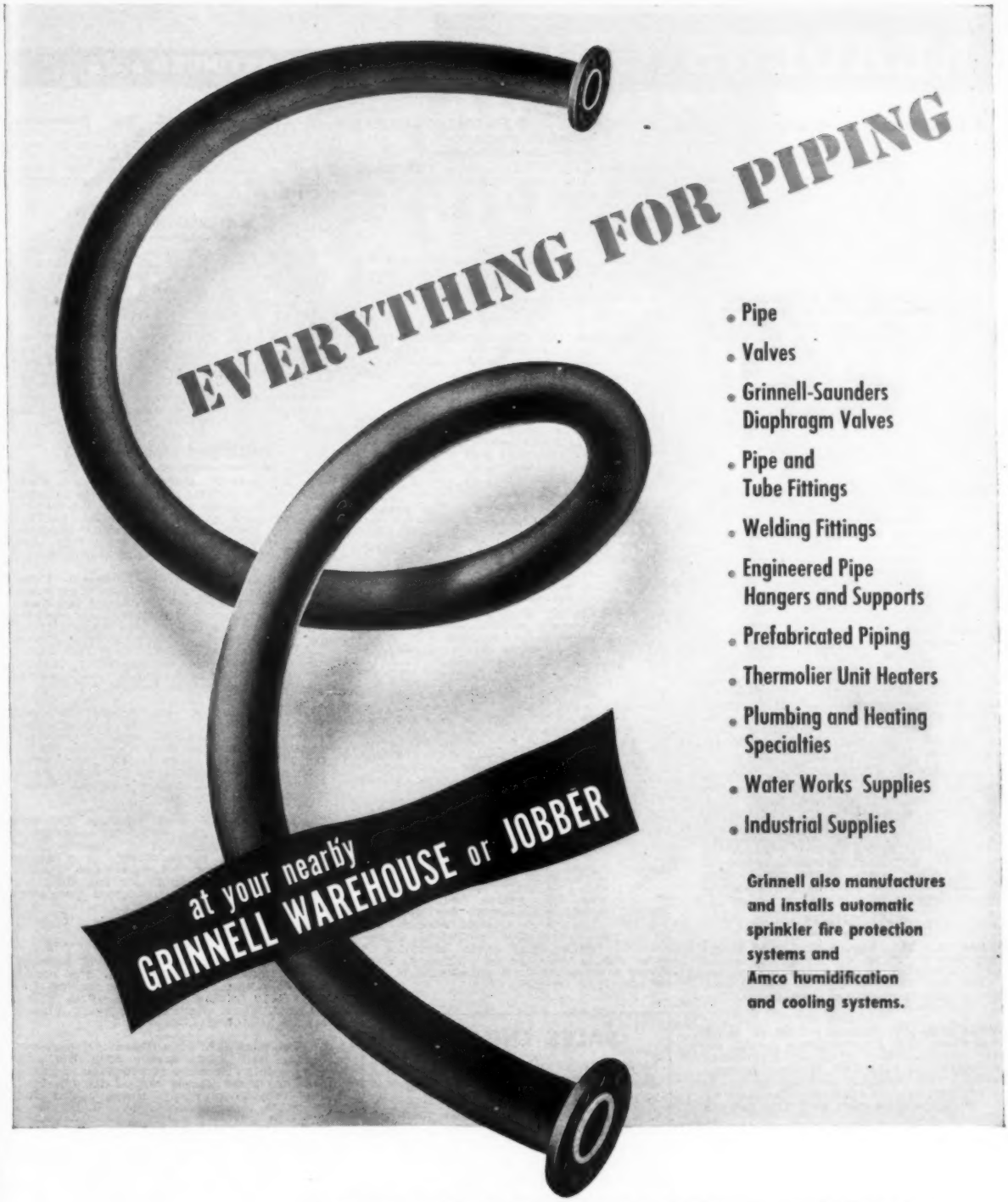
ELECTRICAL EQUIPMENT

25—See page 39. G-E Capacitors: A NEW BOOKLET explains how capacitors work and gives specific data to show you what you may expect from them. Write today for Bulletin GEA-5167. Apparatus Dept., General Electric Co.

26—See page 131. Magnetic Starters: Write today for literature giving full particulars on the new Arrow-Hart 2-Speed and Reversing Magnetic Starters. Used extensively for speed control operations requiring inching, jogging and direct reversing. The Arrow-Hart & Hegeman Electric Co.

27 — See page 145. Voltage Regulators: Write today for full details on Stabiline Electro-mechanical Voltage Regulators. Available for a wide range of applications in 115, 208, 230, 440 volt, single and three phase ratings: capacities to 100 KVA. The Superior Electric Co.

(Continued on page 24)



- Pipe
- Valves
- Grinnell-Saunders Diaphragm Valves
- Pipe and Tube Fittings
- Welding Fittings
- Engineered Pipe Hangers and Supports
- Prefabricated Piping
- Thermolier Unit Heaters
- Plumbing and Heating Specialties
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- Industrial Supplies

Grinnell also manufactures and installs automatic sprinkler fire protection systems and Amco humidification and cooling systems.

More than 1000 Grinnell warehouses and jobbers . . . one within easy reach of your phone . . . are ready to give you prompt delivery on any standard piping product. When the job calls for specialized piping products or installations, Grinnell has the manufacturing facilities, products, experience and engineering knowledge to "deliver the goods".

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READERS' GUIDE ... CONTINUED ...

(Continued from page 22)

FLOOR REPAIRS

28—See page 157. Tough Resurfacer: Rugged-Wear resurfacer stands up under the most punishing traffic conditions. For broken concrete or wood floors. Makes durable patch or complete overlay. Used indoors or out. Dries fast. Send for free trial offer and "Handbook of Building Maintenance." No obligation. Flexrock Company.

FUELS AND FIRING EQUIPMENT

29—See page 73. Pulverizer: Write for complete data on Ball Mill Pulverizers. Low maintenance, sustained fineness of pulverization—respond instantly to controls—handle as much as 30 to 40 tons of coal per hour. Foster Wheeler Corporation.

30—See page 27. Fanmix Gas and Oil Burners: Bulletin 410-6 gives complete data on Coppus-Dennis Fanmix burners that allow you to get more heat release per cu. ft. of furnace volume. Coppus Engineering Corp.

HEATING, VENTILATING AND AIR CONDITIONING

31—See page 162. Fans and Blowers: These fans and blowers move more air—yet cut power costs per cubic foot to lowest possible level. Maintenance costs remain at low level year after year. Contact Hartzell representative or write for full information. Hartzell Propeller Fan Co.

32—See page 160. Heating Specialists: Petro-Chem Development Company engineers. They can supply the whys and wherefores of indirect versus direct heating and the economics of both. Every day more than 600 oil and gas fired Petro-Chem Iso-Flow installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation. Write for additional details. Petro-Chem Development Co., Inc.

33—See page 15. Wall Radiation: Three styles of enclosures available. Fedders wall radiation provides new lower cost, easier, greater space saving installation, lighter weight, easier handling, easier stocking. They permit increased efficiency of transferring heat. Pattern stamped in fins creates turbulent scrubbing action of airflow against fins. Write for Catalog WR-C1 for complete information. Fedders-Quigan Corporation.

INSTRUMENTS

34—See page 152. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

35—See page 150. Humidity Control: Send for Bulletin 302 for complete details on these pneumatically operated Hygrostats for controlling valves or dampers in connection with heating or cooling coils, humidifiers, air washers, humidifying atomizers, spray nozzles, etc. The Powers Regulator Co.

36—See page 135. All-Metal Thermometers: Easy readability, combined with rugged, all-metal construction, assures long-time dependability. Thermometers for most industrial applications—wide variety of types. Write for Thermometer Bulletin. Weston Electrical Instrument Corp.

37—See page 156. Ernstlit Adjustable Inclined Column: Send for Bulletin T-1 which contains specifications of the Ernstlit adjustable inclined column, specially designed for package type boilers up to 300 pounds W.S.P. Full information, too, on Leakless Try Cocks. Write today. Ernst Water Column & Gage Co.

INSULATION

38—See page 117. Powerhouse Cement. Write for your copy of booklet describing this new finishing cement that insulates. Only one coat needed—gives smooth, hard surface. Adheres to blocks, blankets and cements. Baldwin-Hill Company.

LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

39—See page 28. Lubriplate Lubricants: Ask for facts and figures on the variety of oils and greases developed to give protective lubrication to your machinery even under conditions of moisture and acids. Fiske Brothers Refining Co.

40—See pages 42, 43. Turbine Oil: Ask for more information about Sinturlite, which is non-foaming, non-corrosive and separates readily from water. Sinclair Refining Co.

41—See page 153. Centralized Lubrication: Ask for free Catalog No. 25 and Case Studies showing how to save oiling labor, bearing expense, production time and lubricant. The Farval Corporation.

42—See page 115. Lubricants: This company offers a wide selection of "Job Proved" petroleum products. The know-how of their engineers and detailed product information are yours for the asking. Sun Oil Company.

43—See page 65. 11 Ways to Cut Production Costs: Write for your copy of this free, new booklet which is yours without obligation. You will find handy coupon on page 65. Alemite Corporation.

MAINTENANCE

44—See page 21. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete catalog. Rust-Oleum Corporation.

45—See page 158. Complete Service for Elevated Water Tanks: 32 years' experience means safety, service, and satisfaction on every water tank reconditioned by Dixie Tank and Bridge Co. Write for your free copy of publication, "Sound Principles of Water Tank Maintenance and Tank Talk". Dixie Tank and Bridge Co.

46—See page 155. Free Repair Handbook: Filled with time-saving, money-saving uses for Smooth-On in plants and shops. Clear, practical directions. 170 illustrations. Send today for your copy. Smooth-On Mfg. Co.

47—See page 140. Motor and Generator Inspection and Maintenance Service: Hyre Electric Company's electric service will help you keep your electrical equipment in top working order. If motor or generator is too large for shipment, Hyre comes to your plant. Write or call for full details. Hyre Electric Co.

SALES ENGINEER

Now it is possible to PREVENT formations and accumulations of Slag and Fireside deposits on boilers and furnaces. Our new System causes the complete combustion of the Combustibles in the furnace area. The Ash is deposited in the Ash Zone instead of entering the tube bank or building up, on the walls. Smoke Control is an accomplished fact. This System was developed through long research by a Nationally known, well established Manufacturer.

The importance of this new development to Industry offers an exceptional opportunity to Sales Engineers throughout the East, South and Midwest, who have Combustion experience in the Industrial and Utility Power Plant fields.

State experience and qualifications in reply.

Box 6 **Industry and Power,** St. Joseph, Michigan.

48—See pages 35, 36. Rust Preventive: Check with the Standard Oil Lubrication Specialist near you for advice on such products as Stanorust 1-XC, a rust preventive especially developed for severe outdoor service. Or write to Standard Oil Company (Indiana).

MATERIAL HANDLING

49—See page 137. Pneumatic Ash Handling System: Economical, labor-saving "Vac-Veyor" conveys and delivers the ashes to the silo in a completely dry condition. Write for more information. Beaumont Birch Co.

50—See page 123. Diesel Electric Locomotives: Porter engineers will be glad to survey your switching requirements and submit specifications for a standard or, if necessary, a special unit designed to your individual requirements. A Porter engineer can show you how to cut your switching costs. H. K. Porter Company, Inc.

PACKINGS AND GASKETS

51—See page 57. Navalon Packings: Made of ramie, a natural fiber that gets stronger when wet, these packings are for service against fresh or salt water, brine, cold oil and for use on pumps, elevators, accumulators, presses and reciprocating rods. Ask for Folder PK-32A. Johns-Manville.

52—See page 41. Piston Packing: Pumcups offer two advantages that often mean a saving up to $100 per pump per year. First, downtime and material and maintenance costs are cut because Pumcups last longer. Secondly, volumetric efficiency is held constant. Write for these free bulletins—No. 4401 for reciprocating pumps; No. 4502 for air or hydraulic mechanisms. Darling Valve & Manufacturing Co.

53—See page 28. Super-Seal Packing: Highly resilient, graphite impregnated, homogeneous plastic packing is ideal for centrifugal pumps. Won't give up its lubrication, won't score shafts. Does away with continual adjustment problems. Send for a sample you can try yourself. Crane Packing Company.

55—See page 61. Sheet Packing: You can rely on these gasket sheets for long, trouble-free service. "Pyroid" resists high pressures and temperatures, is a dense pliable sheet of exceptional tensile strength. Send coupon for full data on "Pyroid" and other R/M sheet packings. Raybestos-Manhattan, Inc.

PIPE AND FITTINGS

56—See page 23. One-Stop Piping Service: Get complete information on the broad line of piping products—pipe, valves, fittings and piping specialties—that make Grinnell your one stop for every piping layout. Grinnell Company, Inc.

57—See page 127. Pipe Unions: Bronze-to-bronze ball joints insure long life and tight joints. Because of precision in manufacture these unions can be disconnected and reinstalled many times. Send for complete information today. E. M. Dart Mfg. Co.

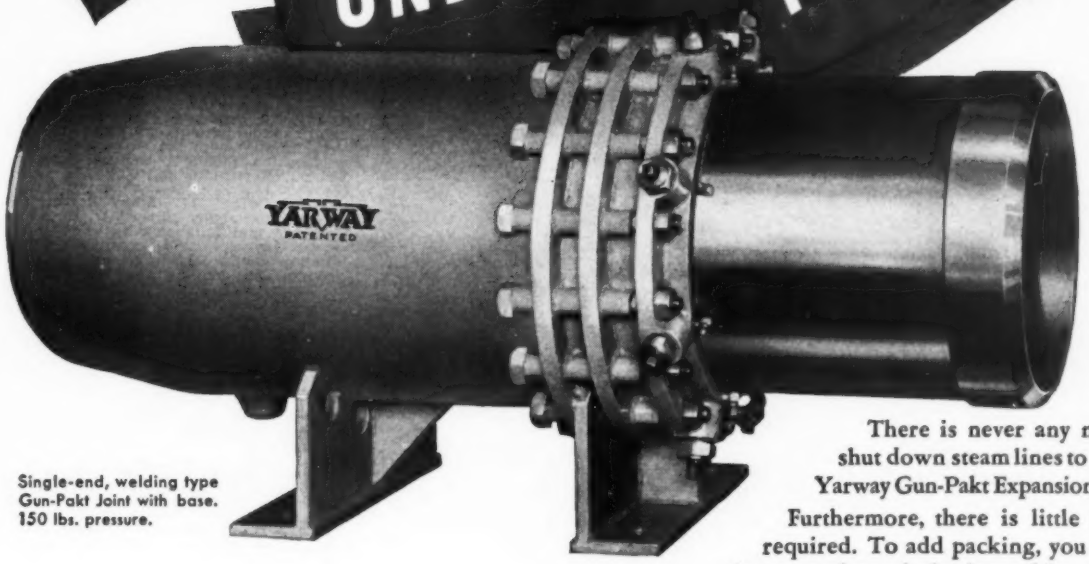
54—See page 52. Piping Equipment: Small steel valves with big valve features—600-pound small steel gates with union bonnet, for steam, water, gas, or air give you lighter, more compact operation than usual high pressure design yet are amply strong. Write for Circular AD-1741 for complete information. Crane Co.

58—See page 31. Copper Tubes: Copper is the answer to any industrial application where rust is taboo. Anaconda Copper Tubes are busy serving industry in thousands of different ways. When you turn to copper remember Anaconda. The American Brass Company.

59—See page 49. Flexible Metal Tubing and Metal Hose: Write for literature describing the many uses and types for handling steam, water, oil, solutions, semi-solids, or gases. American Metal Hose Branch, The American Brass Company.

(Continued on page 26)

THIS EXPANSION JOINT IS SERVICED UNDER FULL STEAM PRESSURE



Single-end, welding type Gun-Pakt Joint with base. 150 lbs. pressure.

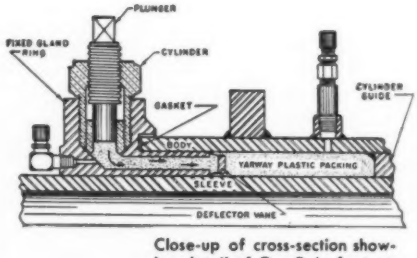
There is never any need to shut down steam lines to service Yarway Gun-Pakt Expansion Joints.

Furthermore, there is little service required. To add packing, you simply insert a plug of plastic packing, turn a wrench, and the job's done! Special Alemite fittings provide for proper lubrication.

Maintenance costs are trifling. One large user reports 65 cents per year per joint. Others claim less than that.

Gun-Pakt Joints are available with single or double-ends, welding or flanged types, in sizes from 2″ to 30″, with traverses from 4″ to 24″, and for pressures to 400 psi.

For the full Gun-Pakt story, write for Yarway Bulletin EJ-1912.



Close-up of cross-section showing detail of Gun-Pakt feature.

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

YARWAY **GUN-PAKT EXPANSION JOINT**

The Ideal Packing for Centrifugal Pumps
"JOHN CRANE"
SUPER-SEAL®
over fifteen years of outstanding service records
SUPER-SEAL No. 1
...Now with "tape-back" reinforcement
★ SIMPLIFIED RING CUTTING—Easily pulled down to any shaft or stem size.
★ POSITIVE PACKING IDENTIFICATION—Each style marked in a different color.
Super Seal is an extremely resilient, graphite impregnated, homogeneous plastic packing composed of asbestos, metallic particles and special binders.
This packing is ideal for centrifugal pumps in a wide variety of power plant services. It doesn't give up its lubrication, it stays resilient and it won't score shafts. You'll find it will outlast any packing you've tried. There are no continual adjustment problems with Super Seal, because it stays put!
"Tape-back" construction meets your need for flexibility without breakage—for ring cutting without waste. Here, for the first time, is a plastic packing which can be handled as easily as braided fabric styles.
It's hard to believe the resilience of "tape-back" SUPER SEAL until you twist it down yourself. Send for a sample and try it.
JOHN CRANE
CRANE PACKING COMPANY
1831 CUYLER AVENUE • CHICAGO 13, ILLINOIS
Offices in All Principal Cities in United States and Canada

READERS' GUIDE

(Continued from page 24)

60—See page 66. Flexible Stainless Steel Hose: Light weight, high strength, leak-proof, highly resistant to corrosion, this corrugated, stainless steel hose withstands extreme cycles of vibration, flexation and variplane motions. CMH REX-FLEX in sizes from 5/16" through 6" I. D.—with helical or annular corrugations, with or without metal braid covering. Write for full information. Chicago Metal Hose Corporation.

61—See page 29. B & W Tubes: Write for new Bulletin T B 329 for full information on seamless and welded heat exchanger and condenser tubes. For quick service on your tubing requirements for original equipment or replacement contact your nearest B & W Tube representative. The Babcock & Wilcox Tube Company.

62—See page 154. WECO "Junior" Unions: Made for 3,000 lb, non-shock cold working pressure, in sizes ⅛" thru 2". Illustrated brochure available for complete information. Write for your copy today. Well Equipment Mfg. Corp.

63—See page 25. Gun-Pakt Expansion Joints: Send for free Bulletin EJ-1912 for the full story on Yarway Expansion Joints. Insert a plug of packing, turn a wrench, the joint's tight and all under full steam pressure. Write today. Yarnall-Waring Company.

PLANT EQUIPMENT

64—See pages 46, 47. Chains: This company specializes in the manufacture of sprocket chains, sprockets and attachments. An inquiry will show you how this specialization means better service to you. The Union Chain and Mfg. Co.

65—See page 157. Steel Posture Stool: Heavy, pressed steel, welded for strength, rigidity and long service. These posture stools invite correct, comfortable posture that promotes worker productivity. Light weight, adjustable back rest. Write for full details in Bulletin No. 704. Standard Pressed Steel Co.

66—See page 143. Telephones: Available in wall or desk model, easy to install, inexpensive for interdepartment communication. Write for free folder. Eastern Telephone Company.

67—See page 141. Twin-Weld Hose: This modern hose gives double safety, double convenience to acetylene welding equipment. Oxygen line and acetylene line are actually bonded into one piece, yet separate easily for coupling to tanks and torch. Does away with dangerous mass of tangled individual lines. Saves time in getting welding equipment into operation, simplifies reaching work, changing position and permits work at close quarters. For all welding, cutting and chipping service. Write for full information. Hewitt-Robins Incorporated.

POWER TRANSMISSION

68—See page 55. Chain Drives: Rex Chabelco line of chains and sprockets are specifically designed for drive service on equipment where steady, uninterrupted service is a "must". Many sizes now available from stock. For all the facts on their lower over-all cost, write Chain Belt Company.

(Continued on page 28)

TO GET YOUR FREE COPIES OF THIS NEW LITERATURE CIRCLE THE CORRESPONDING NUMBERS ON ONE OF THE CONVENIENT POST CARDS ON PAGE 71. MAIL A CARD TODAY. NO POSTAGE NECESSARY.

How to *INCREASE BOILER RATINGS*

with your present furnace and stack

Coppus-Dennis FANMIX Burners Give You More Heat with No Other Major Change in Equipment

Coppus-Dennis FANMIX Burners give you *perfect* mechanical mixing of fuel and air *at the burner outlet . . . instantaneous* ignition close to the burner . . . and *complete* combustion *without visible flame* when burning natural gas. No other burner combines these three advantages.

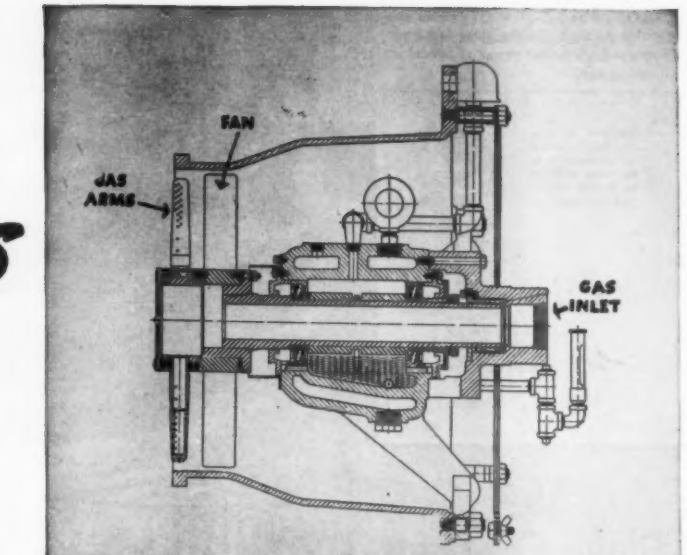
Because FANMIX delivers the *right* mixture of fuel and air *without blow-torch action*, all of your furnace space is used for combustion . . . *none for mixing*. That's why your present furnace can release more heat . . . why new installations can get more heat out of smaller furnace space.

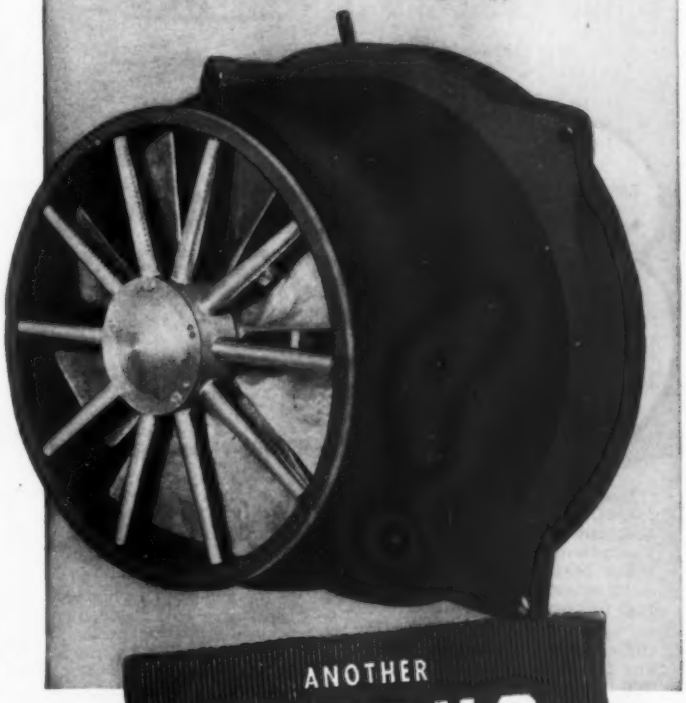
Because FANMIX can be guaranteed to secure complete combustion of natural gas *with less than 5% excess air*, you get uniform "radiant heat" *without drifting hot spots*. That's why a FANMIX-fired furnace seldom varies in temperature more than 5% over its entire area.

WRITE FOR ALL THE FACTS

When you see in Bulletin 410-6 how fuel escaping from orifices in rotating driver arms rotates the fan to draw the correct proportion of air into the path of the fuel at right angles . . . how FANMIX creates its own forced draft, reduces stack requirements, prevents cracking of "wet" gas . . . how two FANMIX types handle either gas or oil or any combination of both — you'll understand why FANMIX Burners have such wide acceptance in oil refineries and power plants.

Send for the Coppus-Dennis FANMIX Bulletin 410-6. Coppus Engineering Corporation, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, and REFINERY CATALOG.





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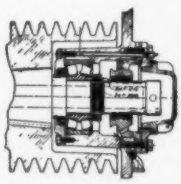
GLOBE ROTO-CUT meat cutters are the standard of the Packing Industry. They produce better meat products at higher speed.

The Ball Bearing and The Spherical Roller Bearing on the cutter shaft of the GLOBE ROTO-CUT machine.



The Globe Company says:

THIS LUBRICANT INCREASED BEARING LIFE FROM 2 WEEKS TO 2 YEARS

"After we had quite a few of our large high speed ROTO-CUT meat cutting machines in actual production operation, the ball and spherical roller bearings on the cutter shaft gave us serious trouble. Some bearings did not last even two weeks.

"In an effort to correct the difficulty, we contacted a number of the large lubricant manufacturers. We tried all the lubricants their engineers recommended without the slightest success. We checked with the manufacturers of the bearings who assured us that the bearings were not overloaded. The trouble was the condition that prevails throughout the meat packing industry, animal acids and moisture, a combination most harmful to ball and roller bearings.

"Then, Ball Bearing LUBRIPLATE was called to our attention. The results we obtained from its use were most gratifying and amazing. We have had these ROTO-CUT machines lubricated with Ball Bearing LUBRIPLATE in continuous operation, twenty-four hours a day, three hundred days a year for over *two years without a single bearing replacement.* We now use LUBRIPLATE for factory lubrication and recommend it to our customers for use on practically all the equipment we manufacture."

THE GLOBE COMPANY
Frank J. Bilek (Chief Engineer)

YES, LUBRIPLATE LUBRICANTS ARE DIFFERENT! They reduce friction, wear and power consumption . . . prevent rust and corrosion and last longer than ordinary lubricants. LUBRIPLATE Lubricants are available from the lightest fluids to the heaviest density greases. There is a LUBRIPLATE product best for your every lubrication need. Write for case histories of the use of LUBRIPLATE in your industry.

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Newark 5, New Jersey • Toledo 5, Ohio

DEALERS EVERYWHERE • SEE YOUR CLASSIFIED TELEPHONE BOOK

LUBRIPLATE the Modern Lubricant

READERS' GUIDE

(Continued from page 26)

69—See page 53. Multi-V-Drives: Write for latest bulletin on Worthington Multi-V-Drives—gives you full explanation of how 15 exclusive, or original, features including the Worthington QD Sheaves will save you money. Send today. Multi-V-Drive Sales Division, Worthington Pump and Machinery Corporation.

70—See page 161. Gear Type Couplings: For trouble-free coupling service write for full catalog on Waldron gear type couplings. Solid cover sleeve, non-welded—no metal-to-metal wear—hermetically sealed. John Waldron Corporation.

71—See page 3. Compass Belt: Goodyear compass belts proved to give 8 times longer service. Write for full information. Goodyear Tire & Rubber Company.

72—See page 152. Worm Gear Speed Reducers: New vertical speed reducer designed specifically for agitators and mixers and for use with supplementary low-speed spur gear drives without outboard bearings. Write today for Bulletin 125. The Cleveland Worm & Gear Co.

73—See page 2. Roller Chain Drives: Diamond Chain offers the machinery designer the same advantages for intra-machine applications as it does for the primary drives. Wherever shafts are to be driven, regardless of speed or direction of rotation, Diamond Roller Chains can do the job efficiently. Write for full details. Diamond Chain Company, Inc.

74—See page 17. Roller Bearings: Cylindrical Roller Bearings provide high load capacity, long life and shaft location. May be used on any application where two bearings are mounted opposed to locate shafts or gears in both directions. Catalog 547 gives full information on all ten types of Hyatt Hy-Loads. Write for your copy. Hyatt Bearings Division, General Motors Corporation.

PUMPS

75—See page 64. "How To Get Longer Service From Your Pumps": That's the title of a booklet that belongs in the files of every man concerned with operating, maintaining, or purchasing pumping equipment. Be sure to write for your copy now. The International Nickel Co., Inc.

76—See page 144. Well Water Systems: Yours for the asking—catalogs and bulletins fully describing Layne Well Water Systems. The unfailing service and many advantages of this completely dependable system make the purchase price even more reasonable. Layne & Bowler, Inc.

77—See page 121. Unipumps: For efficient liquid handling in your plant, consult a Weinman representative. Unipumps handle capacities up to 1000 g.p.m., heads to 500 feet. The Weinman Pump Mfg. Co.

78—See page 45. Pumps: Warren pumps contribute to peak dependability and efficiency, long lift and low maintenance, with special emphasis on safety. Sound investment over the years. Write for Bulletins 241 and 244 for complete details on Warren pumps for higher pressure services. Warren Steam Pump Company, Inc.

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READERS' GUIDE ... CONTINUED ...

(Continued from page 28)

REFRACTORIES

79—See page 163. Refractories: Write for details on the B & W Refractories. Learn how they can cut operating costs in all types of industrial furnaces—large or small. The Babcock & Wilcox Co.

80—See page 151. Castable Refractory: Moldit Chrome saves installation time on floors and walls of boilers. Mixed with water, can be poured, troweled, shoveled or shot in place like concrete. No pounding or ramming needed. Gives exceptionally long life. Bulletin R-48 gives complete details—Write today. Refractory & Insulation Corp.

REGULATORS AND CONTROLS

81—See page 137. Boiler Feed Regulators: Write for complete details on the Henszey line of boiler water level controls, made for pressures up to 600 lbs. and in sizes up to 4 inches. Henszey Co.

82—See page 156. Regulators and Thermometers: Write for Bulletins 500 and 1000 for full information on the Trerice Self-Operating Regulator and its companion piece, the Trerice Dial Thermometer. Their low initial cost will be repaid many times over during their first year of service. H. O. Trerice Co.

83—See page 159. Feed Water Regulators: Easily installed, requiring no expert servicing, Campbell feed water regulators hold the level in your boiler with amazing dependability and accuracy. Send coupon for descriptive literature on Campbell boiler feed water regulators and other Atlas valves, controls and regulators. Atlas Valve Company.

84—See page 19. Cooling Controls: Catalog No. 600 gives you full information on self-contained, self acting controller used for steam, water, brine and gas valves. Catalogs 700 and 800 give you information on Sarco blender—a three way mixing valve that delivers liquids at constant temperatures regardless of pressures. Sarco Company, Inc.

85—See page 147. Regulators: Type G has valves located at end instead of below the float chamber. This cuts down working parts by one-third — saves maintenance costs. Available in either a piston or an orifice valve unit. Simple, compact design; for w.s.p. up to 250 lbs; another model from 300 to 400 lbs. Write for Free Bulletin on Stets Type G Regulators and complete line of liquid level controllers. Stets Company.

86—See page 155. Interfacial Tensiometer: Measures interfacial and surface tension, performing extremely important service for you in testing and control of transformer, lubricating and Diesel engine oils. On transformer oils, for example, tensiometer readings indicate sludge condition or breakdown point. Eliminate cost burn out of transformers—saves replacement oil. Write for detailed information on No. 70540 Tensiometer. Central Scientific Company.

108 — See page 156. Mercury Switches: Write for further information on these switches that are not affected by dust, dirt or corrosion. Let Mercoid solve your control problems. Complete catalog sent upon request. The Mercoid Corp.

STEAM TURBINES AND ENGINES

87—See page 44. Terry Turbines: Write for bulletin giving interesting facts about the outstanding features that make the Terry Solid-Wheel Turbine such a dependable driver. The Terry Steam Turbine Co.

TOOLS AND SMALL SPECIALTIES

88—See page 129. Tube Cleaners and Expanders: Write for data on Airetool's cleaner and expander for types of tubular construction in your plant. Airetool Manufacturing Co.

89—See page 134. Portable Power Pipe Threader: You take this light, 26 lb. power threader right with you to the job—operates with ½" portable electric drill. Write for catalog. Armstrong Bros. Tool Co.

TRAPS, STRAINERS AND SEPARATORS

90—See page 164. Steam Trap Book: Send for copy of "Solving Steam Trap Problems" for more information on the uses of the three Super-Silvertop bucket traps for pressures up to 200 psi. The V. D. Anderson Company.

91—See page 125. Trap With No Moving Parts: Provides continuous and complete air and condensate elimination, and visual operation indicator; requires no by pass; fits into line like a valve. Write for Drainator Catalog. The Coe Manufacturing Co.

92—See page 67. Impulse Steam Trap: Discharge continuously under heavy loads, quickly bringing equipment to operating temperature. Keep equipment at peak efficiency by discharging condensate at short intervals, rather than waiting for quantities of it to collect. Small size, easy maintenance, low cost. Write for more details. Yarnall-Waring Co.

93—See page 148. Valves for Fire Protection: Bulletin E-52C supplies complete details on both opening and closing types dip tank discharge, fuel oil shut-off, foam and other fire protection systems. Everlasting Valve Company.

94—See page 118. Thermostatic Traps and Control Valves: Available Catalogs Numbers 250 and 546 furnish complete data on traps and control valves for air, steam, oil, gas, tar or water. W. H. Nicholson & Co.

95—See page 4. Pipe Line Filters: Staynew Double Action Pipe Line Filter's exclusive double action principle guarantees both clean and dry air. You get, in one unit, both mechanical separation and filtration. Complete data will be sent on request. Dollinger Corporation.

VALVES

96—See page 153. Multiport Valves: Use electrically operated H&T Poppet type multi-port valves to make your Zeolite Water Softeners or Sand Filters automatic. You get top performance at lower cost. Write for more details. Hungerford & Terry, Inc.

97—See page 142. Butterfly Valves: Write for bulletins describing Rockwell valves for air, gas, liquids and solids. Any desired metal. Pipe sizes to 72". Pressures to 125 psi. W. S. Rockwell Company.

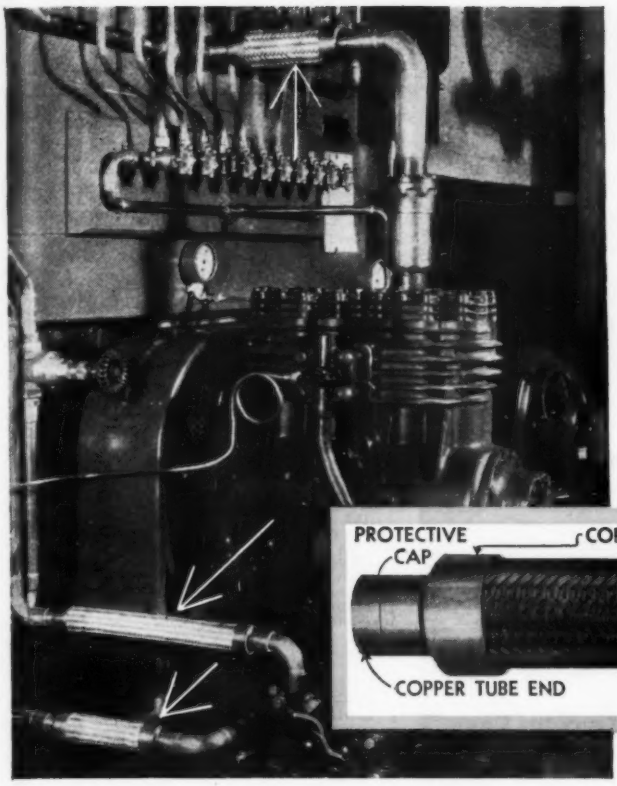
98—See page 62. Steel Valves: If you need gate, globe, angle, or check valves this company can provide you with an unusually wide variety for almost every engineering requirement. The Chapman Valve Mfg. Co.

(Continued on page 32)

READERS' GUIDE

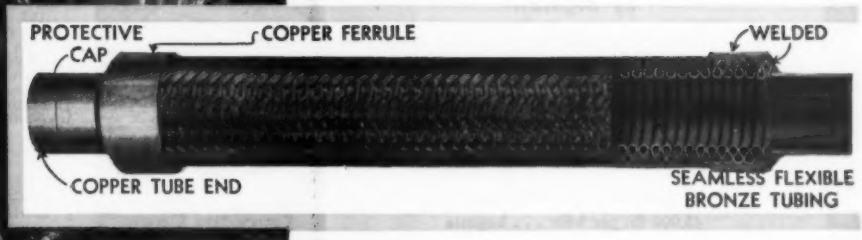
Look on page 22 for a classified list of free literature offered by advertisers.

You'll find it so convenient to use one of the postcards on page 37 for requesting literature or more information about advertised products. Just circle the numbers corresponding to the material you want and drop the card in your OUT basket. Your inquiry will be processed quickly and accurately.



it's the sign of

a vibration-free job . . .



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COMPRESSOR VIBRATION and noise is muffled plenty in a line equipped with an American Vibration Eliminator. What's more, the line that absorbs vibration is far less apt to fail from fatigue.

An American Vibration Eliminator is the finest product of its kind. The corrugated bronze tubing is *seamless*. Copper ferrules and tube ends are *bronze welded*. Each unit is pressure-tested under water, is spotlessly clean and dry, with ends firmly sealed. Individual packages are clearly marked. You get the best when you buy "American."

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50,000 lb. per hour . . . oil fired

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ST. MARY'S SUGAR, Sorel, La.
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GENERAL E. L. LOGAN AIRPORT, E. Boston, Mass.
65,000 lb. per hour . . . oil

CHINA AMERICAN PAPER CO., Shanghai, China
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INTERNATIONAL SILVER CO., Wallingford, Conn.
30,000 lb. per hour . . . oil

PETER PAUL, INC., Philippine Islands
12,000 lb. per hour . . . coconut husks

Throughout industry, Bigelow boilers are piling up service records of efficient steam production. Each successful installation is further evidence of Bigelow's boiler-making experience. Each is operating proof of Bigelow's ability to build boilers to answer a wide range of steam requirements.

Every one of the hundreds of Bigelow boilers holding down vital power jobs is another reason for you to consider Boilers By Bigelow for your plant.

Write for free catalogs on any of the units listed here.

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READERS' GUIDE

(Continued from page 30)

99—See page 150. Valves: Bulletin "A-P" shows how Valvair's three body styles (2-way, 3-way, 4-way, and piped exhaust) plus many methods of actuating, provides over 103,000 variations to suit just about any possible set of requirements you may have. Send for your copy right away. Valvair Corporation.

100 — See page 133. Complete Line of Valves: This company manufactures a complete line of valves for controlling the flow of water, steam, gas, oil, and chemicals. Consult them without obligation. The Fairbanks Company.

101—See page 159. Plug Valves: These rubber-faced, metal-cored plugs seal air-tight every time—no friction, no lubrication. Write for new catalog on these easy operating plug valves. DeZurik Shower Co.

102—See page 69. Bronze Valves: Write for Circulars 566 and 582 for full information on these 125 lb. valves. Describes gate, globe, angle, swing check, and lift check valves. Made of finest materials, metallurgically tested and approved, sound engineering design, perfect alignment of parts. The Lunkenheimer Co.

WELDING EQUIPMENT

103—See page 58. Prest-O-Lite Kit: Kit contains 4 stems and a soldering copper—complete for every air-acetylene job from the heaviest to the most delicate. Weighs only 5 lb. 13 oz. with its own carrying case. Write for more details on the 5-in-1 precision outfit. The Linde Air Products Company.

WIRE ROPE

104—See page 37. Preformed Wire Rope: With no pent-up stresses held within the rope structure this rope operates over sheaves and drums with less fatigue. Complete data on request. Wickwire Spencer Steel Div. of Colorado Fuel & Iron Corp.

MISCELLANEOUS

105 — See page 7. Plant Construction: Thinking of a new plant? Addition to or modernization of present facilities? Modern construction and mechanical installation methods bring costs to a reasonable price. For additional information on McGraw's specializing in industrial plants and mechanical erection write for illustrated publication, "Plans & Projects". F. H. McGraw & Co.

106—See page 138. Mechanical Engineers' Handbook: Two volumes—one on power and one on design and production give you 20% more information with most recent data and latest practice, authored by 172 leading engineers. Volumes may be purchased separately. Write for free 10 days examination. John Wiley & Sons, Inc.

107—See page 158. Check This Economy Move: Over 1900 firms supply the more than 33,000 products which Hajoca stocks for industry. Use this one source and eliminate your high cost of dealing with many sources of supply for the industrial products you use. Hajoca Corporation.

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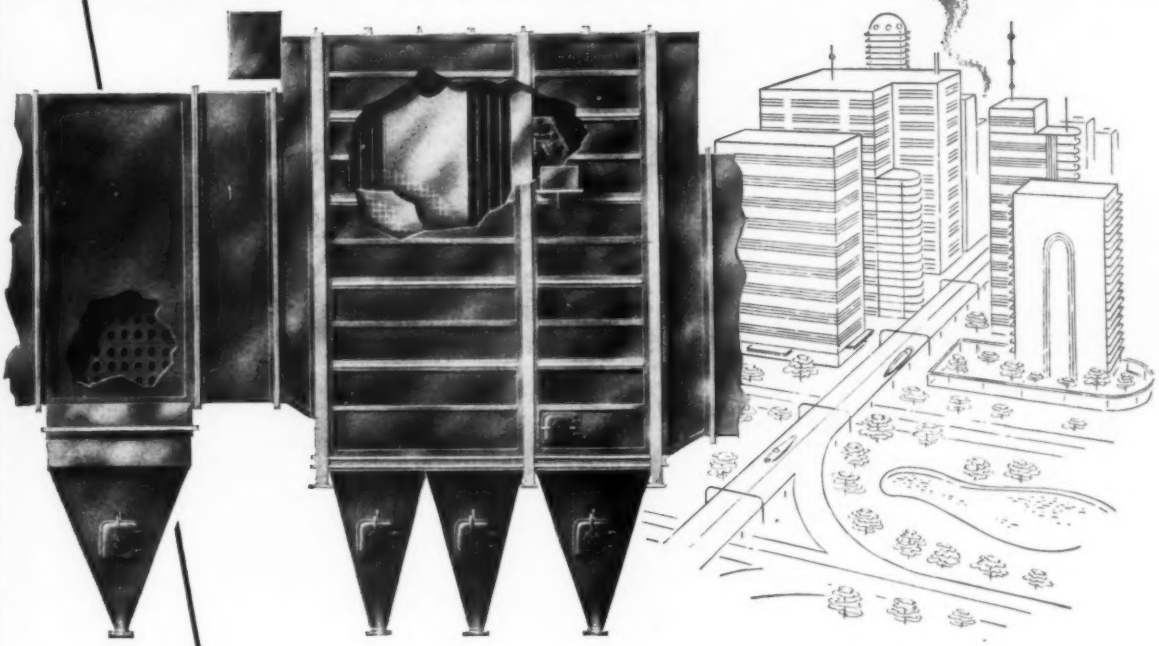

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To plan for the future, a collector should meet today's collection requirements, with provisions made for increasing the efficiency when dust ordinances become more stringent. It is well known that a mechanical collector is economical to operate. Such a collector therefore, that will meet present dust ordinance requirements and serve later as the primary to an electrical secondary, seems the logical choice.

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We all can help keep our country economically strong by pulling strongly in the Treasury Department's Independence Drive, May 15-July 4. Obviously this is important to you, because what's good for the nation is good for you and your company.

The purpose of this drive is to increase everyone's financial independence through the regular purchase of United States Savings Bonds. Your "pull" is needed because the greatest share of Series E Bond sales are made through the Payroll Savings Plan—and the Plan (now used by 21,000 companies) thrives best in any company when it gets top management's personal sponsorship.

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If your company does have the Plan, now's the time to put extra push behind it! Employees who pile up money in Savings Bonds feel more secure . . . are actually better workers. Moreover, Bond sales build a backlog of future purchasing power—good "business insurance" for all of us in the years ahead.

The Independence Drive is being powerfully promoted throughout the nation by radio, television, publication advertising, posters, car cards, and special ceremonies. The public is *extra* Bond-concious at this time. Make sure your company adequately informs your employees that the convenience of "automatic" Bond buying is available through your Payroll Savings Plan.

This is your country—so it's *your Drive.* Help to put it over. All the material and assistance you need are available from your State Director, Savings Bonds Division, U. S. Treasury Department. Go into action now!

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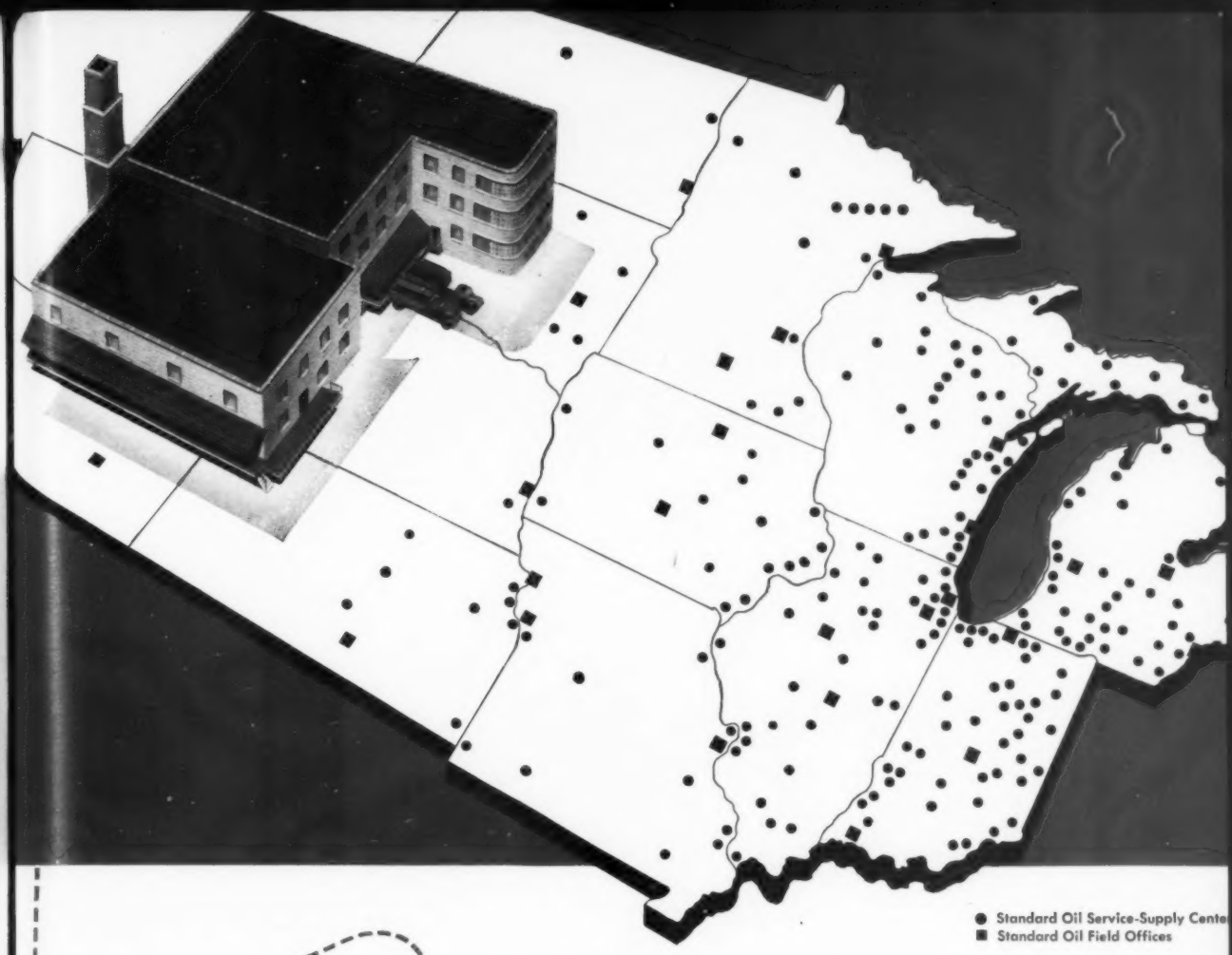

● Standard Oil Service-Supply Cente
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Right in your own back yard!

● If your plant is in the Midwest, you can benefit from a service-distribution set-up that is unique in the oil industry—there's a Standard Oil office and warehouse practically right in your own back yard. The nearness of that service-supply center holds important advantages for you.

Faster Deliveries. You needn't worry about production delays caused by late shipments of necessary lubricants and fuels. You can avoid the expense and trouble of stocking large quantities of lubricants and fuels within your plant.

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To arrange for his visit, phone your nearby Standard Oil service-supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

3 IMPORTANT ADVANTAGES

Standard Oil's Lubrication Service is especially geared to serve your midwest operations.

1 Service-supply points are near your plant. You are assured of fast deliveries, prompt lubrication engineering service.

2 Lubrication specialists have been specifically trained in Standard Oil Lubrication Engineering Schools to help you obtain the maximum benefits from lubricants and fuels.

3 Research and technical facilities are geared to help solve your specific lubrication problems.

STANDARD OIL COMPANY (INDIANA)

STANDARD

What's YOUR problem?

R. L. Jenkins, lubricating specialist at Standard Oil's South Bend office solved this customer's problem because he was thoroughly familiar with job requirements and the application of his Stanorust line.

• There is a corps of such lubricating specialists throughout the Midwest, trained and experienced to help plant operators solve similar problems. Experience enables these men to find quickly the cause of lubricating troubles. Knowledge of petroleum products enables them to prescribe the lubricant needed. There is one of these lubricating specialists at the Standard Oil Company (Indiana) office near you. He is there to serve you. A call or a card will put him at your service.

Investigate the cost-saving possibilities of these lubricants.

STANOIL INDUSTRIAL OILS—for cleaner hydraulic systems, gear cases, compressors, and circulating systems.

CALUMET VISCOUS LUBRICANTS—adhere to open gears and chain drives without throw-off. Easy to apply. No heating.

STANOLITH GREASE—withstands high temperatures and resists washing by water.

THE SHOP FOREMAN of Hart Pressed Steel Corp., Elkhart, Indiana, exposes the clean metal surface beneath a coating of STANORUST 1-XC Rust Preventive by a simple wiping operation. The die shown has been protected against rust under severe outdoor conditions for over a year by STANORUST 1-XC.

How to prevent rust under severe outdoor storage . . .

RAIN, snow, heat, cold—plus coal soot from passing locomotives—could be expected to produce serious rust troubles in outside storage. The elements did, indeed, cause difficulties for the Hart Pressed Steel Corp., Elkhart, Indiana, which owns the truck and trailer dies shown above. Despite coatings of heavy oil, rusting was so severe that cleaning a die required at least three hours.

The problem was laid before a Standard Oil lubrication specialist. He pointed out that, to withstand severe outdoor exposure, a rust preventive with special qualities is needed. At his suggestion, the dies were coated with STANORUST 1-XC, a rust preventive especially developed for severe outdoor service.

Use of a STANORUST Rust Preventive has made savings for this company. Many of the dies have been exposed to the weather for over a year, yet STANORUST has kept them completely protected against rust. A die can now be cleaned and returned to service in a matter of ten minutes, as compared with the three hours previously required.

The new and improved STANORUSTS can mean big savings for you through more economical applications, better rust protection. There's a lubrication specialist near you who can help you get the most economical results. How you can obtain his services is described at left. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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IN THE ROCKIES—The Colorado Fuel and Iron Corp.
Continental Oil Bldg., Denver, Colo.
ON THE WEST COAST—The California Wire Cloth Corp.
1080—19th Ave., Oakland 6, Cal.

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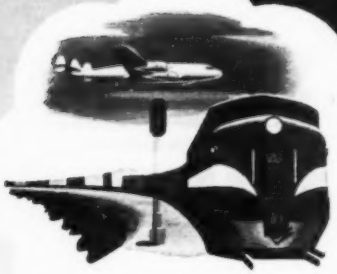
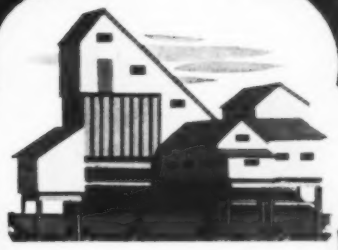
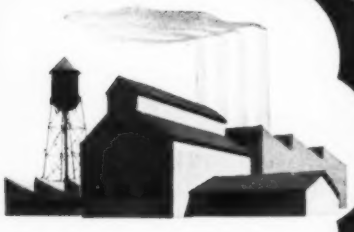


TRANSPORTATION



MINING

PETROLEUM



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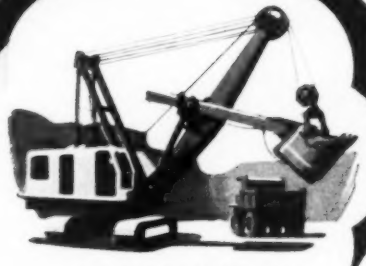
MARINE



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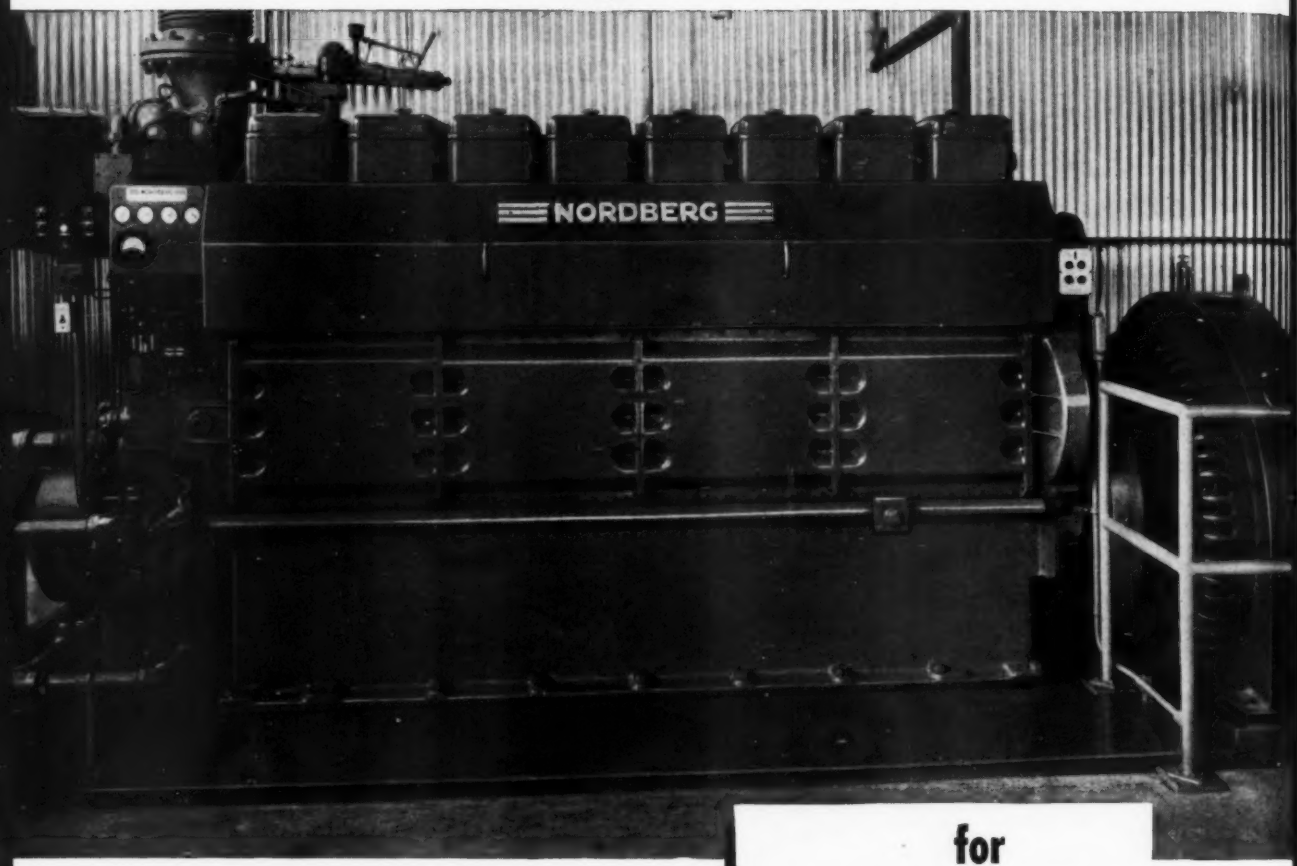


NORDBERG DIESEL for Owens-Corning Fiberglas

. . . THE CASE OF THE "STAND-BY" ENGINE THAT PAID FOR ITSELF IN ABOUT 5 MINUTES!

This 8-cylinder 720 hp. Nordberg Supercharged Diesel is connected to a 500 kw AC generator for emergency power needs at the big Owens-Corning Fiberglas plant at Santa Clara, California. With the process at this particular plant, an interruption of power for more than 5 minutes' duration could raise havoc with the processing machinery. To guard against any such shutdown caused by a failure of purchased power, the Nordberg Diesel is ready to take over the plant load at once. To make sure full power is instantly available, the engine is constantly maintained at operating temperature. Once each day the engine is started, paralleled with purchased power, and the plant load taken over for a short period . . . assuring its readiness, and familiarizing personnel with rapid operating procedure.

This emergency operation has already been handled once by the Nordberg Diesel, which has more than saved its original cost. Here, then, is proved Nordberg Dependability . . . *Ready for instant service.*

NORDBERG DIESELS FOR EVERY POWER REQUIREMENT...10 TO 8500 H.P.

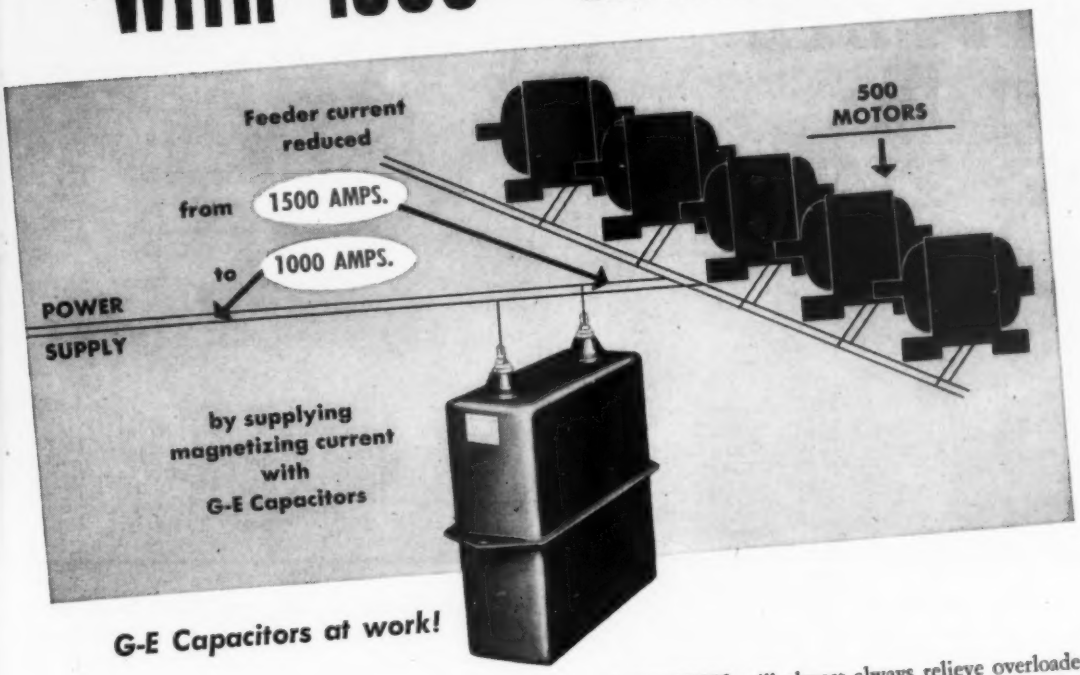
For regular or emergency service, you can't beat the advantages of Nordberg Diesels . . . they can be added to the line quickly, and can be held ready for instant service without exorbitant stand-by expense . . . and in the complete line of Nordberg two and four-cycle Diesel engines, including both oil and gas burning types, you will find exactly the right unit to meet your present and future power requirements . . . from 10 to 8500 H.P.

NORDBERG MFG. CO., Milwaukee 7, Wisconsin

GEARMATIC A DIVISION OF NORDBERG

NORDBERG DIESEL ENGINES

OHIO PLANT CUTS CURRENT 1/3 WITH $1300.00 INVESTMENT



G-E Capacitors at work!

WHEN STANDARD ENVELOPE MANUFACTURING CO. of Cleveland added new equipment, switches overheated and fuses blew. It looked like new wiring was called for. However, investigation showed the culprit to be a low power factor. Total current drawn by 500 motors, many only 1/25 hp, was 500 amperes more than it need be.

G-E CAPACITORS WERE INSTALLED—at a cost of only $1300. Total current dropped one third, production returned to normal, and a re-wiring job was forestalled. Also, because power factor was up to 97%, the company's power bill was reduced approximately $28 a month.

G-E CAPACITORS will almost always relieve overloaded feeders and transformers—and they will usually improve voltage. Where power contracts have a power-factor or kva-demand clause, they may also make possible outright monetary savings. In any event, your electric utility, your contractor, or a G-E specialist can help you determine accurately just what they will save.

Meanwhile, see what others have done with capacitors—ask for our 8-page booklet, GEA-5167. Write Section E407-192 *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

You can put your confidence in—

GENERAL ELECTRIC

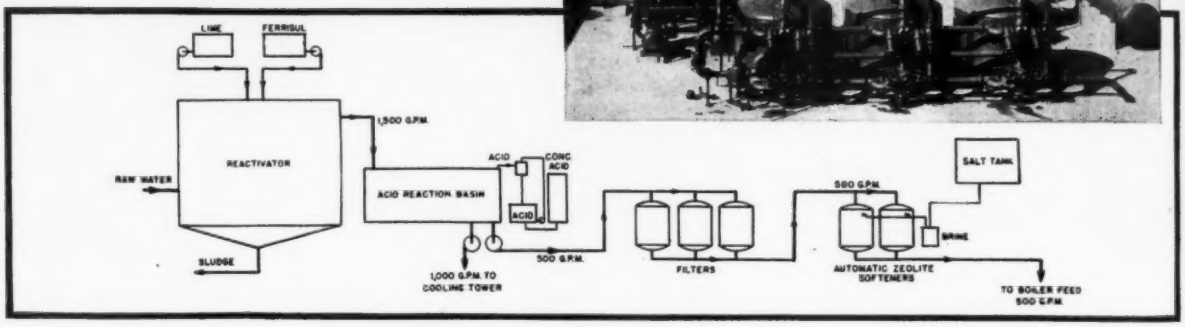
407-192

How Tide Water Oil Uses

GRAVER

FOR

COMPLETE WATER TREATMENT



At Tide Water Oil Company's Avon, California, refinery a turbid hard water supply is completely conditioned for boiler feed and cooling water services by Graver equipment consisting of Reactivator, Acid Feeding System, Anthrafilt Filters and Automatic Zeolite Softeners as shown in the flow chart above.

The raw surface water, with an inlet turbidity of 250 ppm, is first treated with lime and ferric sulfate in the Graver Reactivator. Here, partial reduction of hardness takes place while the turbidity is reduced to 3-5 ppm.

The Graver Acid Feeding System continuously and automatically proportions acid to the Reactivator effluent to reduce the alkalinity and to correct the pH to the desired value. Part of the water is thus conditioned for the cooling water system. The remainder of the water is filtered in the Graver Anthrafilt Filter and softened to zero hardness in the Graver Zeolite Softener for use as boiler feedwater.

The completeness of GRAVER service on this job is further accentuated by the facts that GRAVER:

1. **recommended to the Engineers the most effective type of equipment for their requirements.**
2. **built all the major component parts of each Water Treating Unit in its own shops.**
3. **furnished all needed accessories.**
4. **supervised the installation of the equipment.**

This *single responsibility* assures satisfactory operation of every GRAVER installation.

For best results in solving *your* water treatment problem, get the benefit of GRAVER'S 40 years of specialized experience, proven designs, and unequalled facilities. Be sure to ask for GRAVER recommendations.

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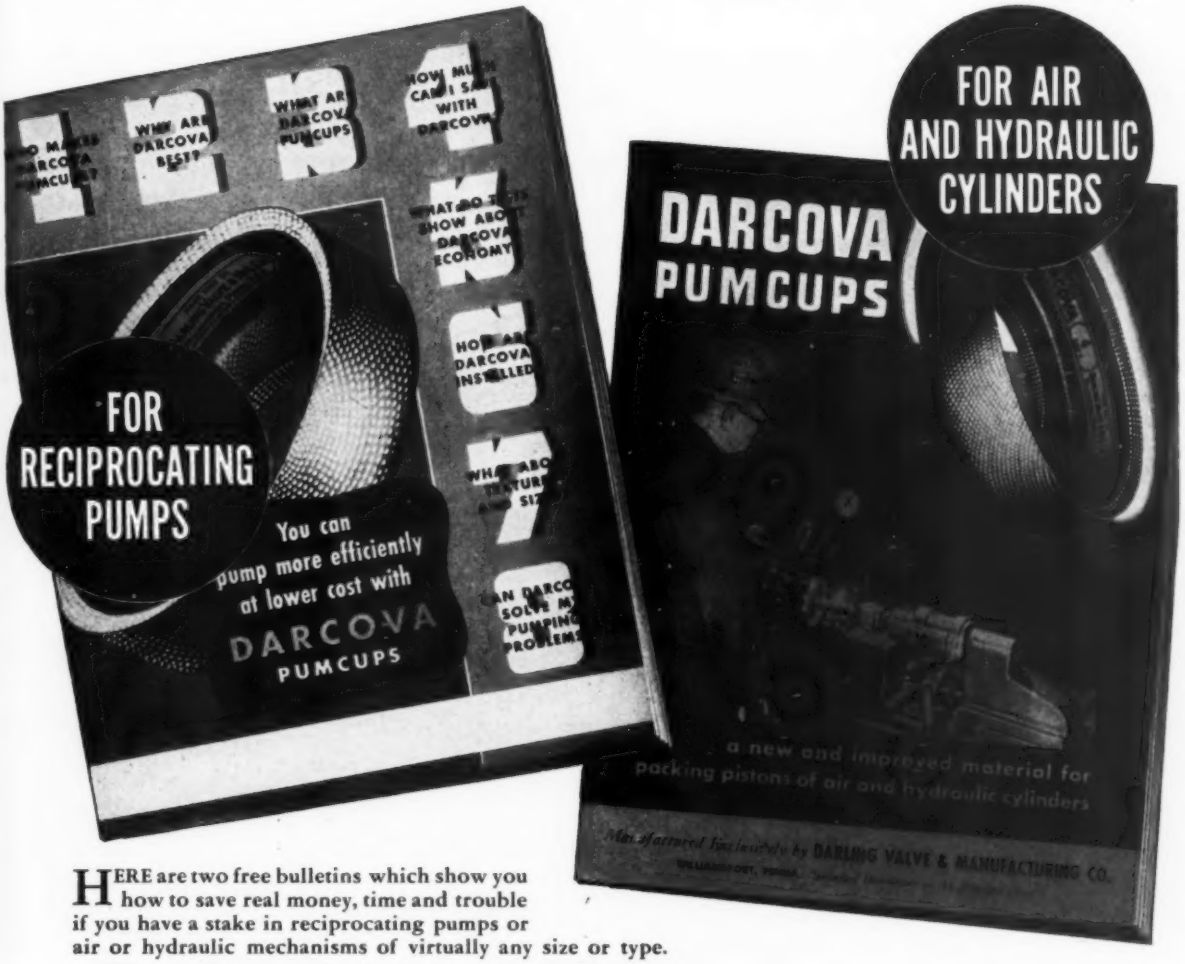
RECOMMENDED READING

ON REDUCING PISTON-PACKING COSTS AND CUTTING OVER-ALL OPERATING EXPENSE!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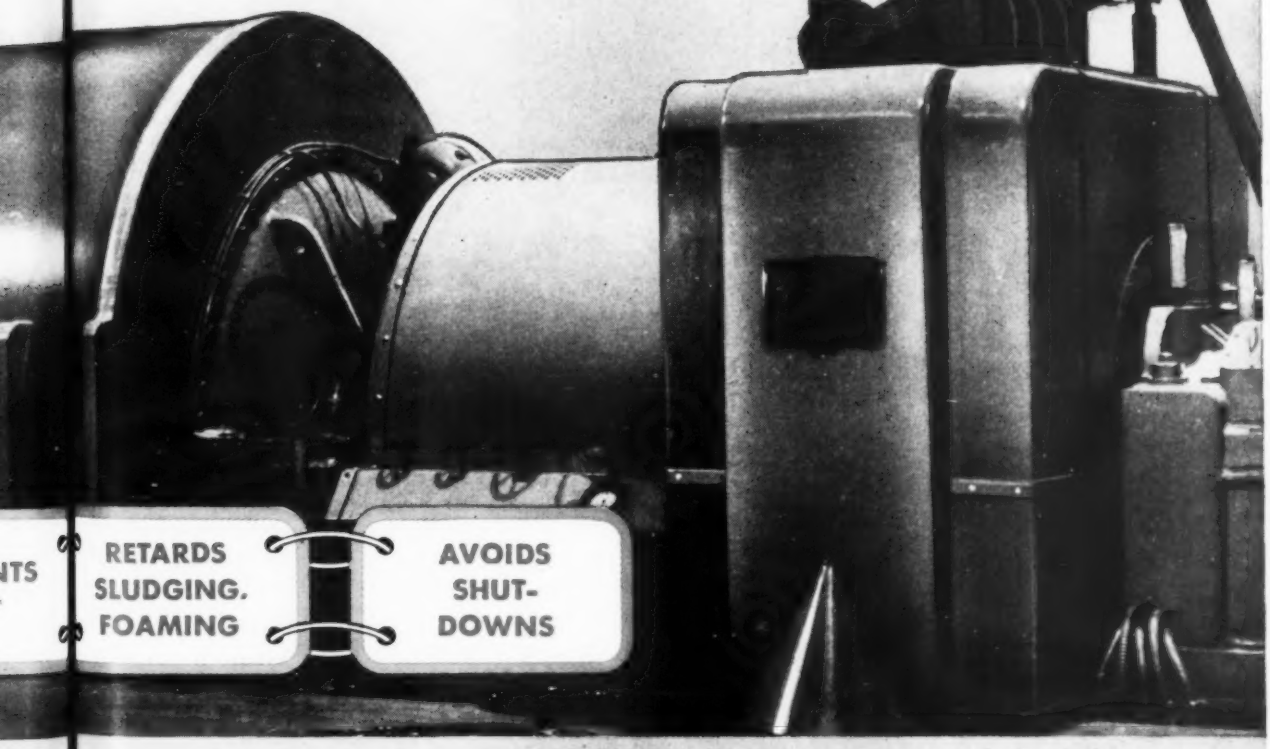
41,000 kw Turbo-generator operating on 750 PSI steam, with Sinclair SINTURLITE Oils. No oil change in over 5 years!



INDUSTRIAL OILS

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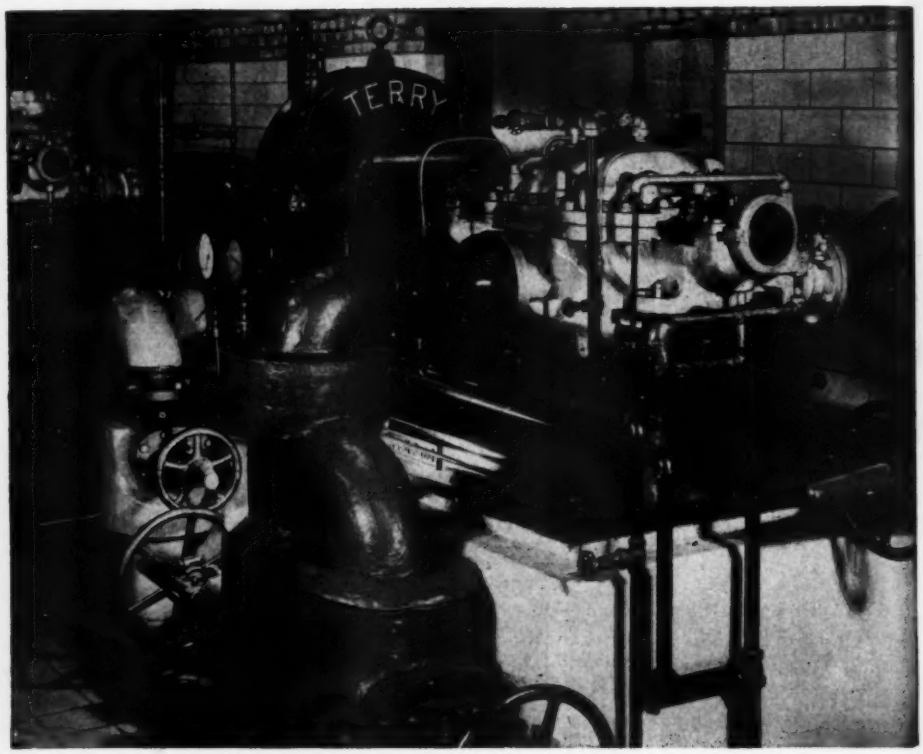
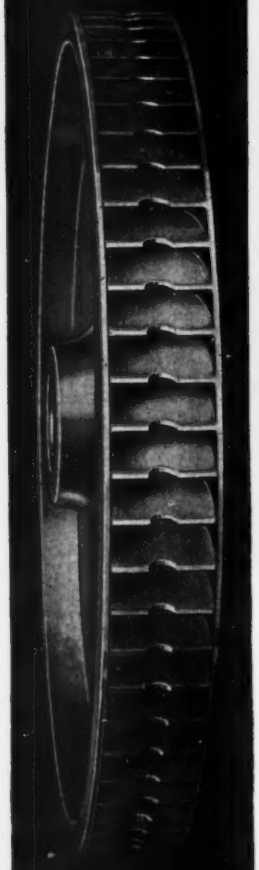




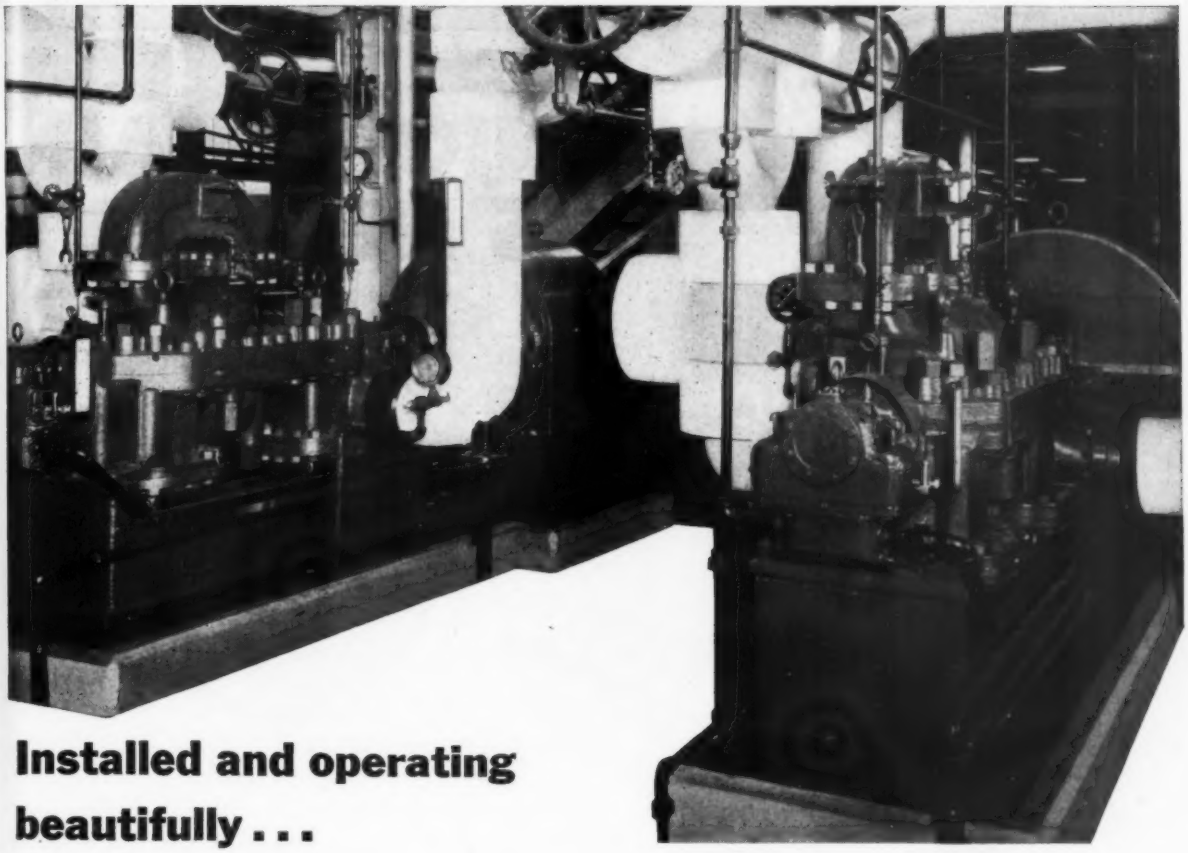
110hp Feed Pump Turbine with Large Safe Clearances

The blades of this turbine are milled out of a one-piece forged-steel wheel with generous clearance both radially and axially. The side clearance is very large — one inch — and the blades are protected by a projecting rim on each side of the wheel. It is therefore impossible for the blades to foul and end play can do no damage to the turbine.

These are but a few of the features that make the Terry Solid-Wheel Turbine such a dependable driver. A bulletin giving other interesting facts about this turbine will be sent upon request.

T 1179

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.



Installed and operating beautifully . . .

TWO WARREN *Big Boys*

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CENTRAL Maine Power Company has had many years of successful experience with Warren Pumps. Among the recent installations are two Type TH high pressure pumps at their enlarged Mason Steam Plant, Wiscasset, Maine. They are operating at capacities of 325 and 550 g.p.m. against a pressure of 900 p.s.i.g. These pumps are also available with a capacity up to 850 g.p.m. and a pressure range up to 1200 p.s.i.g. • Every construction and material feature of these Warren Pumps contribute to the highest dependability and efficiency, long life and low maintenance, with special emphasis on safety. They will prove a sound investment over the years, as numerous other Warren Pumps have in this and many other central power stations, industrial plants, municipal and Federal projects.

Write for Bulletins 241 and 244 giving complete details on Warren Pumps for higher pressure services. P-22

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN MASSACHUSETTS

Wherever You are...

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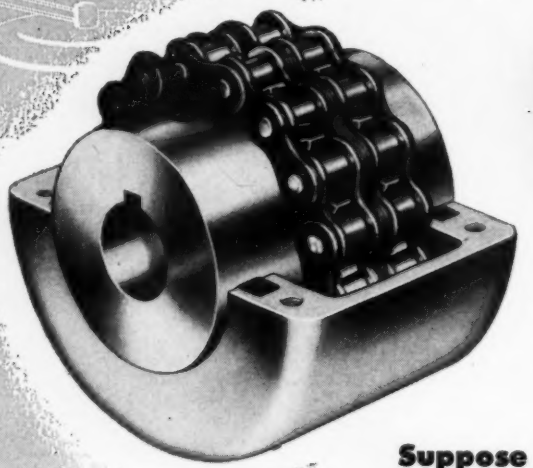

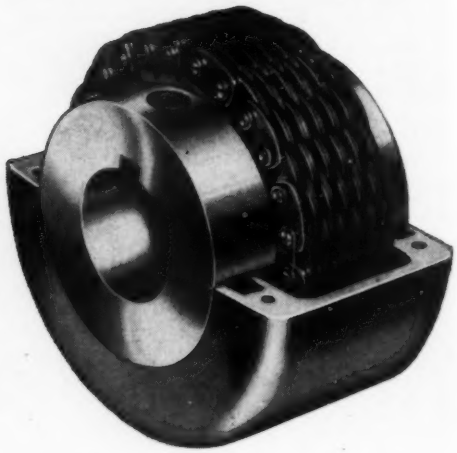

Suppose you need UNION Roller Chain or Silent Chain Flexible Couplings . . .

. . . for replacement or for a familiar application. Just phone or write to your nearest Union Chain stock carrying distributor as listed on the facing page, and the chances are good that he can ship immediately.

. . . *or suppose you need* engineering advice on the proper use of flexible couplings for the joining of two shafts of the same or different diameters in such a way as to allow lateral movement of either shaft and compensate for a slight misalignment of the shafts. Then you should get in touch with the nearest Union Chain district representative as listed on the facing page.

You will receive competent, experienced counsel, since Union Chain manufactures all types of steel drive chains and is thoroughly accustomed to solving power transmission problems for its customers. We will welcome your inquiry.

UNION ROLLER CHAIN

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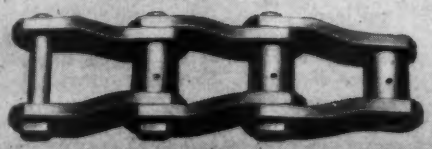

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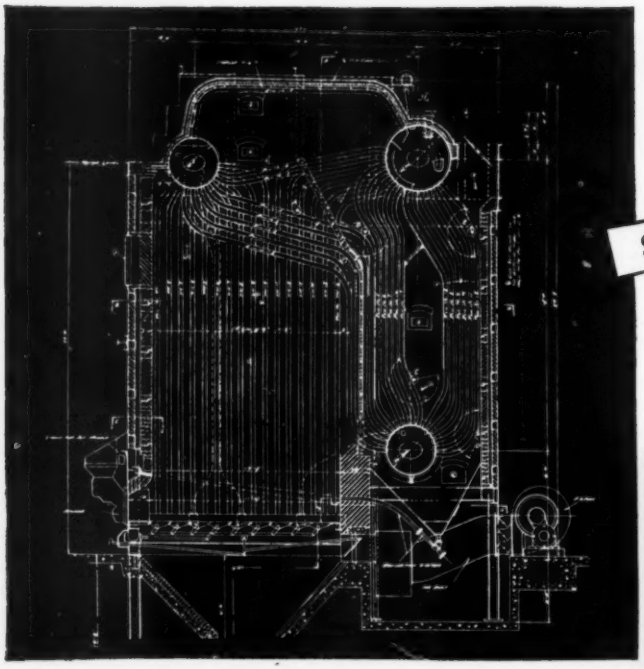
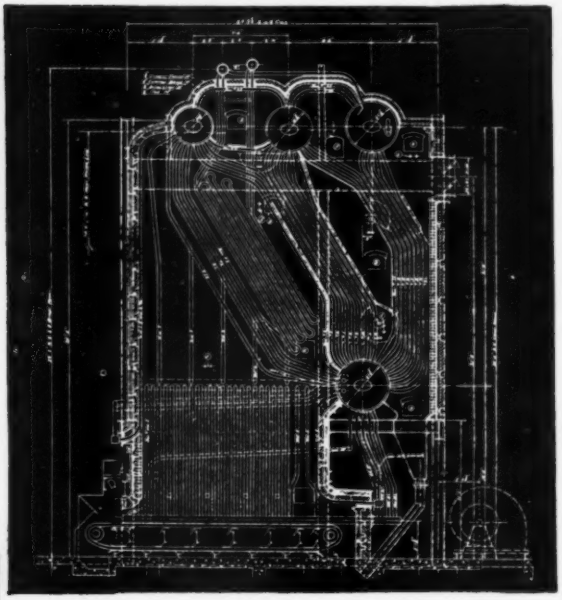


Carry high overloads with high efficiency

SPECIFY Vogt

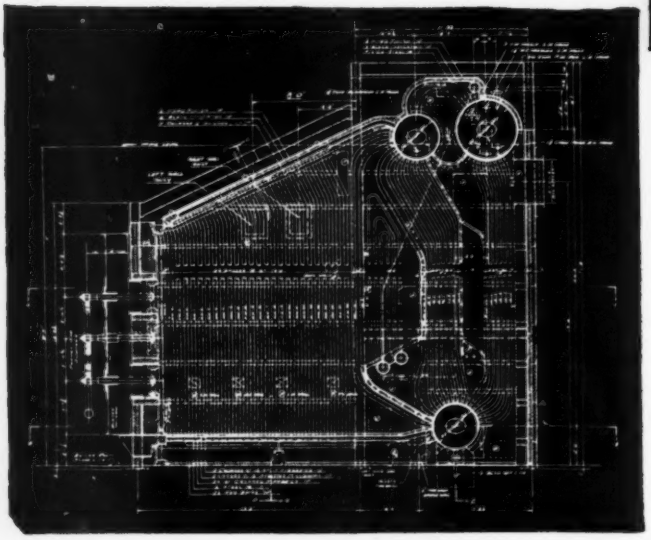
STEAM GENERATING UNITS



CLASS VL Two 27,500 pounds per hour units, installed at Brown-Forman Distillers Corporation, Louisville, Ky. Features large furnace volume in limited space, with high ratio of radiant heating surface.

CLASS LE Mt. Carmel Public Utility, Mt. Carmel, Illinois, is served by this 60,000 pounds per hour unit. Generous steam liberating surfaces and steam space permit wide fluctuations in load.

CLASS VR 70,000 pounds per hour steam generator at Humble Oil and Refining Company, Johnsue, Texas. An efficient, high-duty unit with water cooled furnace, using refinery gas fuel.



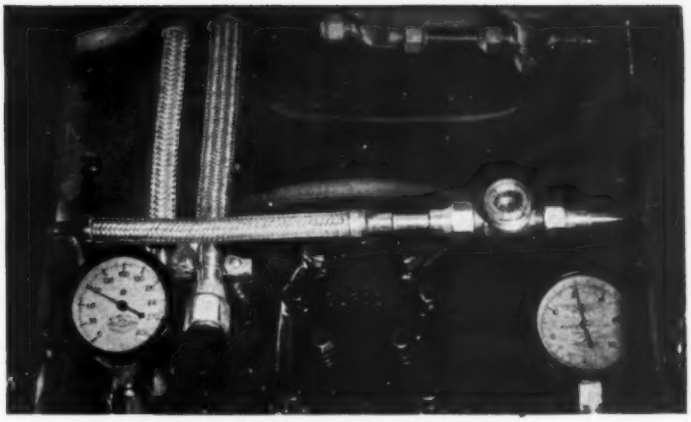
Vogt builds a complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Bulletins with general information and showing typical installations are available upon request.

HENRY VOGT MACHINE CO.

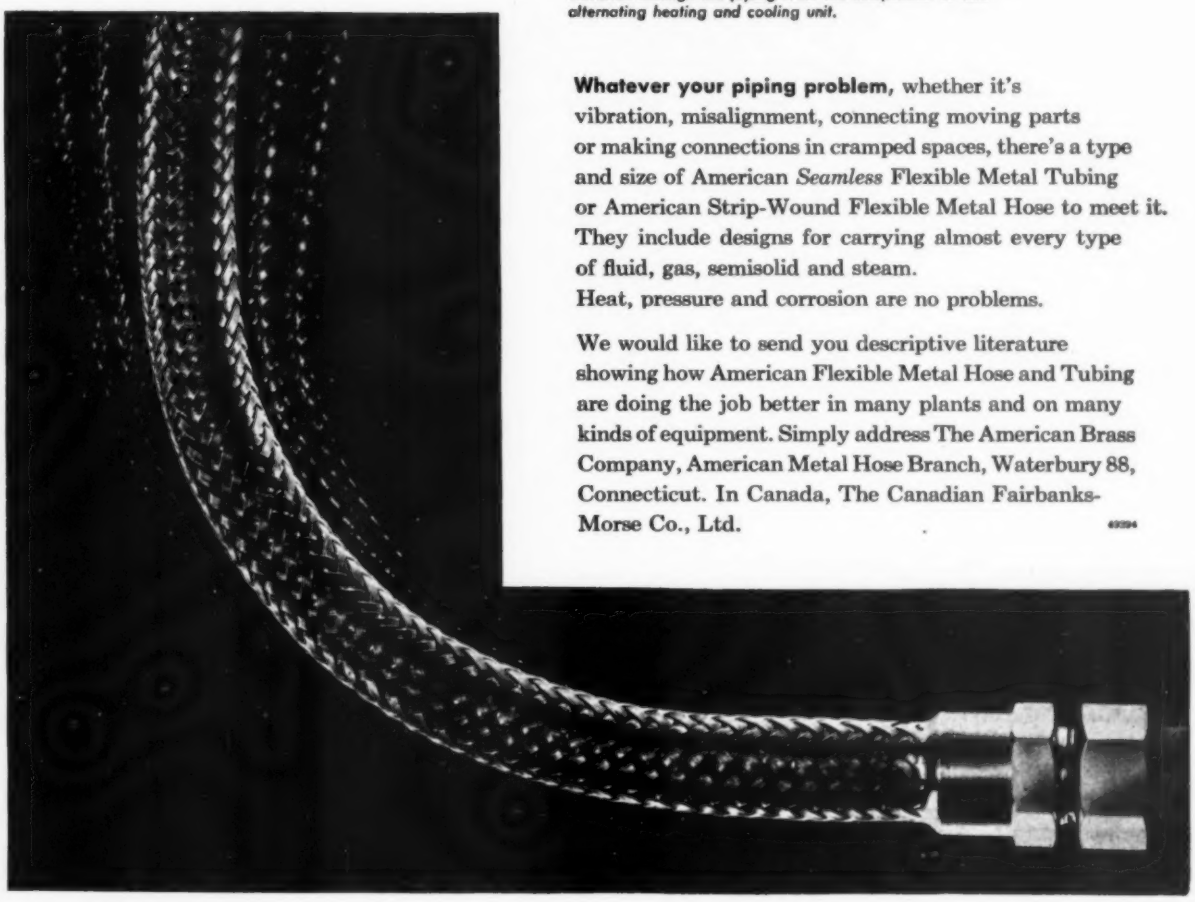
LOUISVILLE 10, KENTUCKY

BRANCH OFFICES:
NEW YORK, PHILADELPHIA, CLEVELAND
CHICAGO, ST. LOUIS, DALLAS

to block vibration and noise



American Vibration Eliminators prevent transmission of vibration through the piping from the compressor of this alternating heating and cooling unit.



Whatever your piping problem, whether it's vibration, misalignment, connecting moving parts or making connections in cramped spaces, there's a type and size of American *Seamless* Flexible Metal Tubing or American Strip-Wound Flexible Metal Hose to meet it. They include designs for carrying almost every type of fluid, gas, semisolid and steam.
Heat, pressure and corrosion are no problems.

We would like to send you descriptive literature showing how American Flexible Metal Hose and Tubing are doing the job better in many plants and on many kinds of equipment. Simply address The American Brass Company, American Metal Hose Branch, Waterbury 88, Connecticut. In Canada, The Canadian Fairbanks-Morse Co., Ltd.

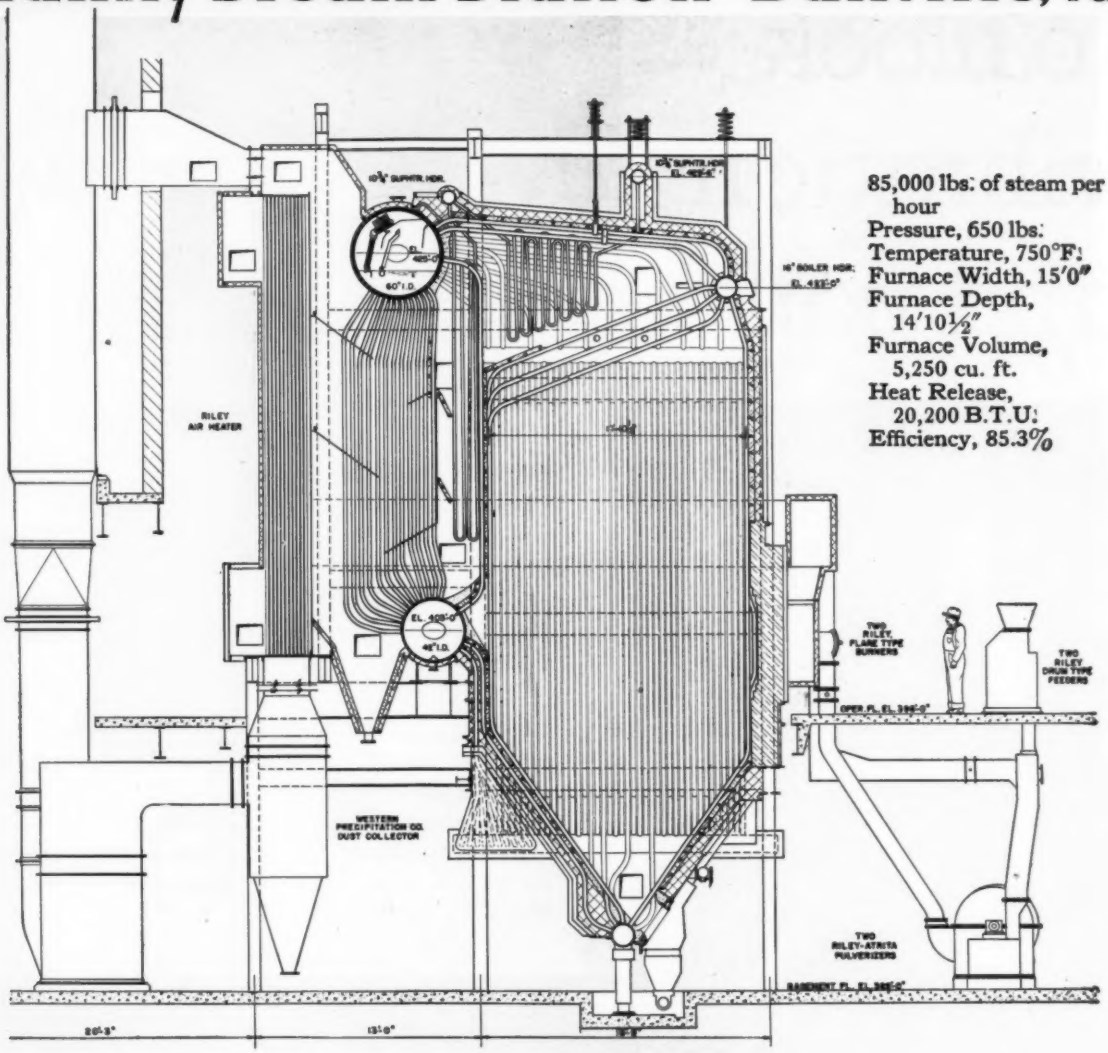
wherever connectors must move

ANACONDA

American

FLEXIBLE METAL HOSE AND TUBING

Brantly Steam Station - Danville, Va.


RILEY AIR HEATER
WESTERN PRECIPITATION OIL DUST COLLECTOR
TWO RILEY FLAME TYPE BURNERS
TWO RILEY DRUM TYPE FEEDERS
TWO RILEY-ATRITA PULVERIZERS

85,000 lbs. of steam per hour
Pressure, 650 lbs.
Temperature, 750°F.
Furnace Width, 15'0"
Furnace Depth, 14'10½"
Furnace Volume, 5,250 cu. ft.
Heat Release, 20,200 B.T.U.
Efficiency, 85.3%

85,000 lbs./hr. Riley Steam Generating Unit—550 lbs. 750°F.

BRANTLY STEAM STATION
CITY OF DANVILLE, VA.

Chas. T. Main, Inc., *Consulting Engineers*

Built under the Auspices of
MAYOR EVERETT E. CARTER — M. R. D. BROWN, *Pres. City Council*
E. M. HAWKINS, JR., *Mgr. of Utilities* — B. G. ADKINS, *Supt. Elec. Dept.*

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

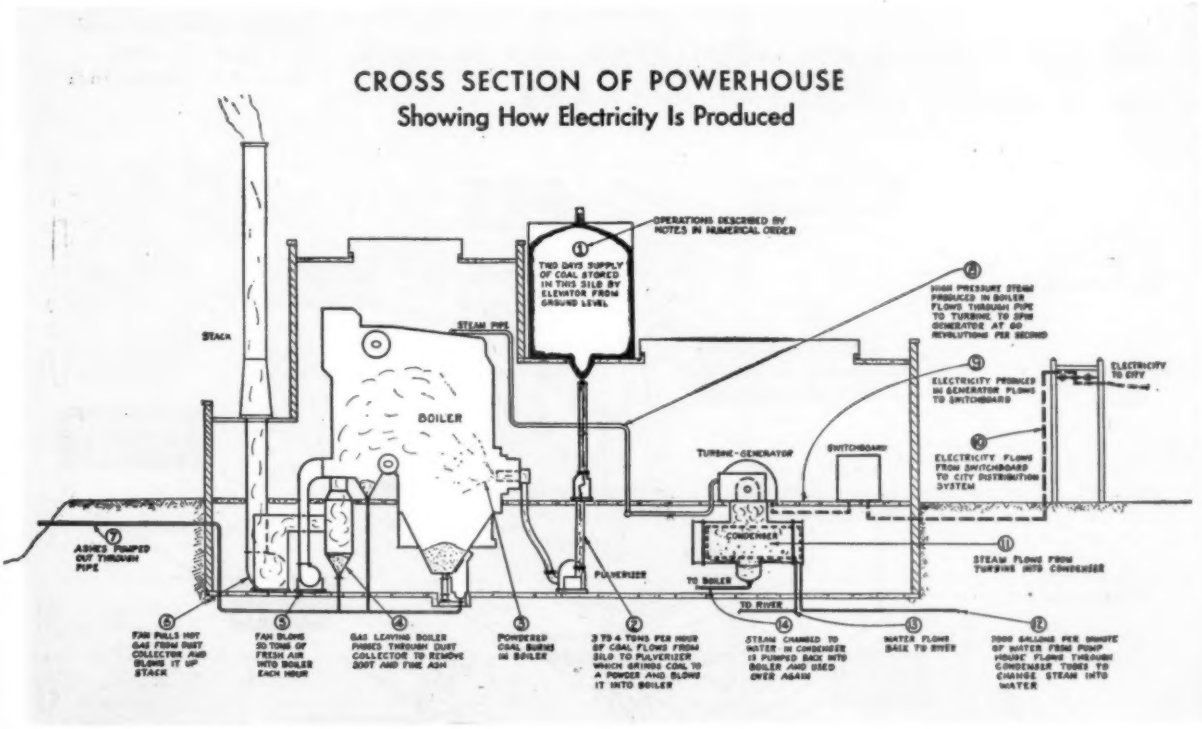
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

A Fine Example of Good Engineering

The new Brantly Steam Station of the City of Danville, Va., recently placed into operation, is a modern, efficient, well-engineered 7,500 K. W. plant, designed to be expanded ultimately to three units. The Riley pulverized coal fired 85,000 lbs./hr. steam generating unit and the generator are located in the same room with the control panel between them as illustrated below.

Like at so many of the more efficient plants today, whether large or small, steam is reliably and economically generated with a Riley Steam Generating Unit, in this case pulverized coal fired by Riley pulverizers and burners. The single header water-cooled hopper bottom Riley unit was selected because it assured efficient trouble-free operation and because its unique hopper design not only reduced the required building height and cost, but eliminated the cost of a separate ash hopper.

While the initial investment savings resulting from the installation of the Riley single header hopper bottom unit are obvious, you have to see this unit in operation to fully appreciate its performance and construction characteristics. Why not visit a Riley installation when you are considering the installation of steam generating equipment. You will then know why so many engineers select Riley as their first choice.


CROSS SECTION OF POWERHOUSE
Showing How Electricity Is Produced
OPERATIONS DESCRIBED BY NOTES IN NUMERICAL ORDER
TWO DAYS SUPPLY OF COAL STORED IN THIS SILO BY ELEVATOR FROM GROUND LEVEL
STACK
STEAM PIPE
BOILER
HIGH PRESSURE STEAM PRODUCED IN BOILER FLOWS THROUGH PIPE TO TURBINE TO SPIN GENERATOR AT 60 REVOLUTIONS PER SECOND
ELECTRICITY PRODUCED IN GENERATOR FLOWS TO SWITCHBOARD
ELECTRICITY TO CITY
ELECTRICITY FLOWS FROM SWITCHBOARD TO CITY DISTRIBUTION SYSTEM
TURBINE-GENERATOR
SWITCHBOARD
CONDENSER
ASHES PUMPED OUT THROUGH PIPE
STEAM FLOWS FROM TURBINE INTO CONDENSER
PULVERIZER
TO BOILER
TO RIVER
FAN PULLS HOT GAS FROM DUST COLLECTOR AND BLOWS IT UP STACK
FAN BLOWS 50 TONS OF FRESH AIR INTO BOILER EACH HOUR
GAS LEAVING BOILER PASSES THROUGH DUST COLLECTOR TO REMOVE SOOT AND FINE ASH
POWDERED COAL BURNS IN BOILER
3 TO 4 TONS PER HOUR OF COAL FLOWS FROM SILO TO PULVERIZER WHICH GRINDS COAL TO A POWDER AND BLOWS IT INTO BOILER
STEAM CHANGED TO WATER IN CONDENSER IS PUMPED BACK INTO BOILER AND USED OVER AGAIN
WATER FLOWS BACK TO RIVER
7000 GALLONS PER MINUTE OF WATER FROM PUMP HOUSE FLOWS THROUGH CONDENSER TUBES TO CHANGE STEAM INTO WATER

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

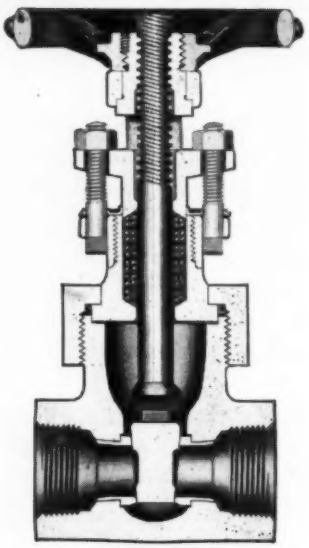
All the piping equipment you need ...on one order to CRANE

SMALL STEEL VALVES WITH BIG VALVE FEATURES

Crane 600-Pound Small Steel Gates with Union Bonnet—for steam, water, gas, or air—are smaller, lighter, and more compact than usual high pressure design . . . yet are amply strong. Metal sections at all points provide extra strength and safety under rough usage and extreme pressure-temperature conditions.

Body, bonnet and yoke are high quality carbon steel. Seating is Hardened Stainless to Exelloy, offering superior resistance to wear, corrosion, and temperature effects. Husky bonnet ring with long, precision-cut threads pulls up easily . . . always stays tight. Long-lived blowout-proof gasket in bonnet joint is unaffected by highest temperatures or fluids on recommended services. For more information, **write for circular AD-1741.**

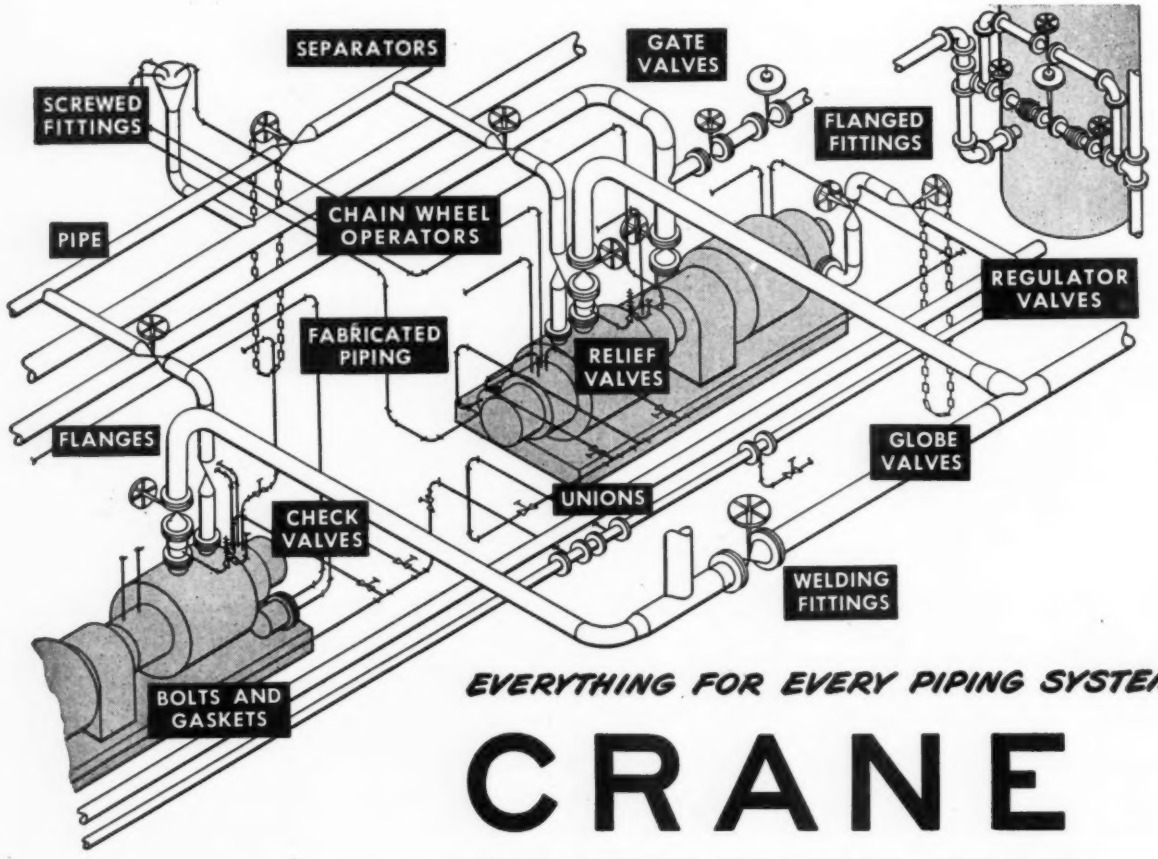
CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



No. 3602XW

For steam up to 850 deg. F., and for water, gas, or air.
Sizes: ¼ to 2 in.
Screwed or welding ends

THIS POWER PLANT INSTALLATION, FOR EXAMPLE, CAN BE COMPLETELY EQUIPPED BY CRANE



EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

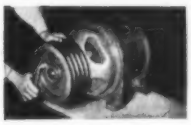
How Does Your Drive Rate on the V-drive Scoreboard?

Here are 15 money-saving features of the most efficient V-belt drive. Only Worthington Multi-V-Drives give you all 15!

These Features Save You Money	For These Reasons	It's a Worthington—
1 Two-piece QD sheave—rim and hub separate	Mount light hub first, then slide heavier rim on tapered hub	EXCLUSIVE
2 Choice of one or two-piece assembly	Mount hub and rim separately, or loosely assemble hub on rim and slide on shaft together	EXCLUSIVE
3 Split hub	Easy to mount, even on oversized shaft	ORIGINAL
4 Clamp screw in hub	Holds hub in position on shaft while setting or removing rim	EXCLUSIVE
5 Taper-mated hub and rim	Mount easily in any position—no keyway between taper surfaces	ORIGINAL
6 Large, long pull-up bolts	Hold better and more uniformly	EXCLUSIVE
7 Friction cone grip	Tightening rim on hub gives positive press fit on shaft	ORIGINAL
8 Shaft key lock (set screw over keyway)	Prevents key from drifting	EXCLUSIVE
9 Quickly-detachable (QD)	Pull-up bolts used as jack screws to remove sheave rim	ORIGINAL
10 Interchangeable rims	Hubs for every bore—lower inventory cost	ORIGINAL
11 No realignment problem	Clamped hub holds shaft position—new rim tightens up in exact alignment	EXCLUSIVE
12 Choice of "A", "B", "C" and "D" grooves	"Tailor-made" grooves give proper belt "ride-out" for maximum life efficiency	ORIGINAL
13 I-beam spokes on driven sheave	Stronger—capable of carrying heavier load with less weight	EXCLUSIVE
14 Offset design of sheave	Reduces over-hang loads—increases bearing life	ORIGINAL
15 Worthington-Goodyear V-belts	Load-carrying cords in neutral axis reduce internal friction—each belt carries its share of drive load	ORIGINAL

EASY TO GET ON

EASY TO GET OFF



YET ALWAYS TIGHT ON THE SHAFT

WORTHINGTON QD SHEAVE
—ORIGINAL TAPERED CONE-GRIP SHEAVE

Complete Range of Stock Sizes—Prompt Shipment. 853 listed stock sizes in "A", "B", "C" and "D" sections, fhp to 600 hp . . . 332 listed stock sizes of EC Cord V-belts. *Send coupon for latest Worthington QD Sheave bulletin.*

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POWER TRANSMISSION: sheaves, V-belts, variable speed drives
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Worthington Pump and Machinery Corporation
Multi-V-Drive Sales Division, Dept. PO-1
Buffalo, N. Y.

Send latest bulletin of Worthington Multi-V-Drives.

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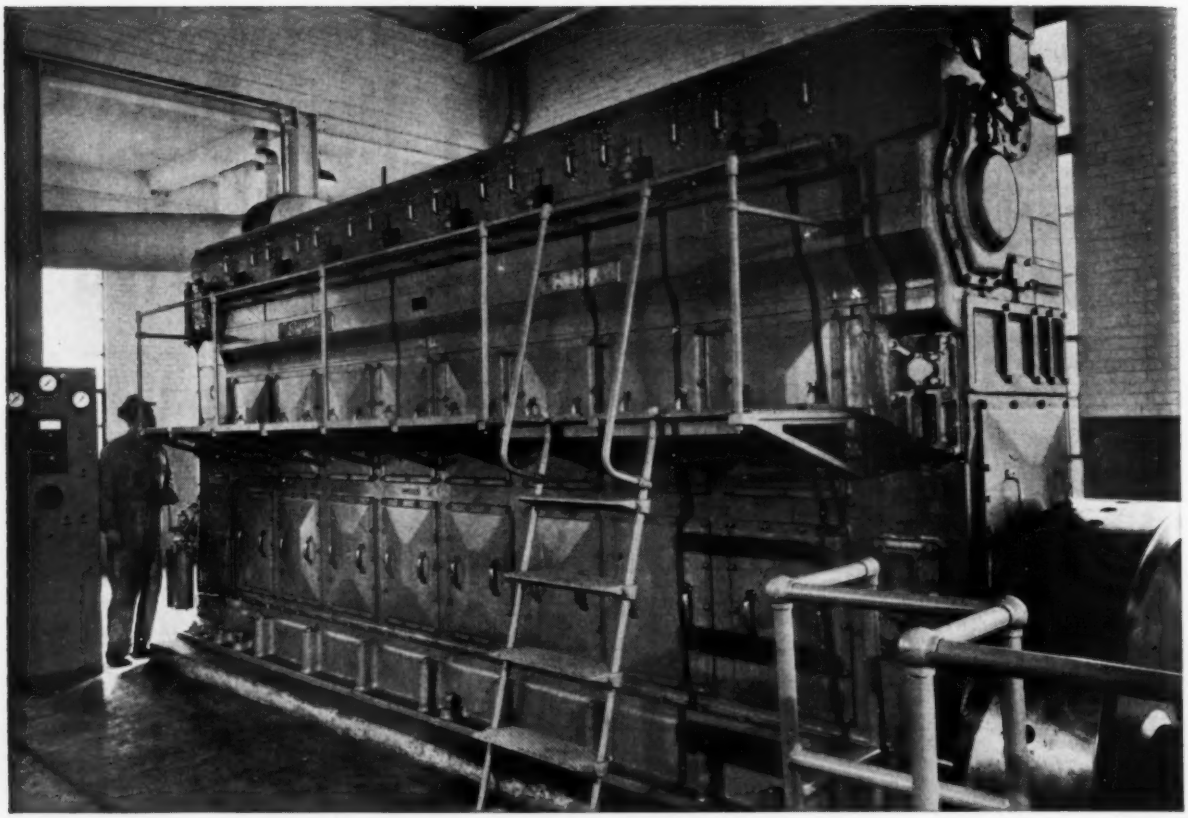

Lower Cost Power From Standby Superior Results in a Full-Time Job

Folks in an Iowa City needed additional power for peak loads to supplement the two steam turbines in their Municipal Power Plant. To get this power economically they chose a Model 80 Supercharged Dual Fuel Superior.

In normal operation in this municipal system the Superior engine operates on gas. But when necessary, the Dual Fuel feature permits instant conversion from gas to oil. All the operator has to do is push a button to select the type of fuel. Mixing adjustments on Superior Dual Fuel engines are automatically controlled for any combination of fuels.

The plant engineers found that the Superior engine was producing electrical power cheaper than the regular steam turbine units. As a result the standby unit was given a full-time job to reduce operating costs.

The remarkable success of this Superior engine application is not unusual. Chances are, the same results can be accomplished for you. A Superior representative will be glad to call at your convenience and show you how it can be done. In the meantime, write for your free copy of *Superior Diesel For Stationary Application.*

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

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Superior DIESELS

Locomotive · Marine · Oil Field · Stationary

NEED MORE "DRIVE" IN YOUR MACHINES?

Rex Light Chabelco . . . *for moderate loads*

Rex Universal Chabelco . . . *for heavy loads at higher speeds*

Rex 3100 Series Chabelco . . . *short pitch chain for high-speed service.*

Rex Heavy Chabelco *. . . for heavy loads*

If you want top performance from your machines . . . if you want drives that stand up under the toughest operating conditions, the Rex Chabelco Line of Chains and Sprockets is the answer.

Specifically designed for drive service on equipment where steady, uninterrupted service is a "must," these husky steel chains *deliver more H.P. per dollar* . . . assure low initial and operating costs . . . and freedom from production loss due to premature drive failure. Often a Rex Chabelco Chain, single or double strand, will handle loads that would require triple or quadruple strands in other types of chain.

Where service is exceptionally severe . . . where equipment must operate under conditions of dirt, dust and temperature extremes, a Chabelco Chain will keep going when other driving mediums would soon fail. Designed-in clearances between working parts enable it to operate efficiently under these conditions and to accommodate minor misalignments.

Many sizes of standard Rex Chabelco Chains and Sprockets are now available from stock. For all the facts on how they can help you put more "drive" in your machines at the lowest over-all cost, call your Rex Field Office or write Chain Belt Company, 1650 West Bruce Street, Milwaukee 4, Wis.

CHAIN BELT REX COMPANY

DRIVE AND CONVEYOR CHAINS

HOW TO SAVE $20,000

ON AN $11,000 INVESTMENT

HOW TO SAVE $4,000

ON A $7,500 INVESTMENT

These are actual Case History Savings

HOW MUCH CAN YOU SAVE

BY INSTALLING A STEAM-PAK GENERATOR

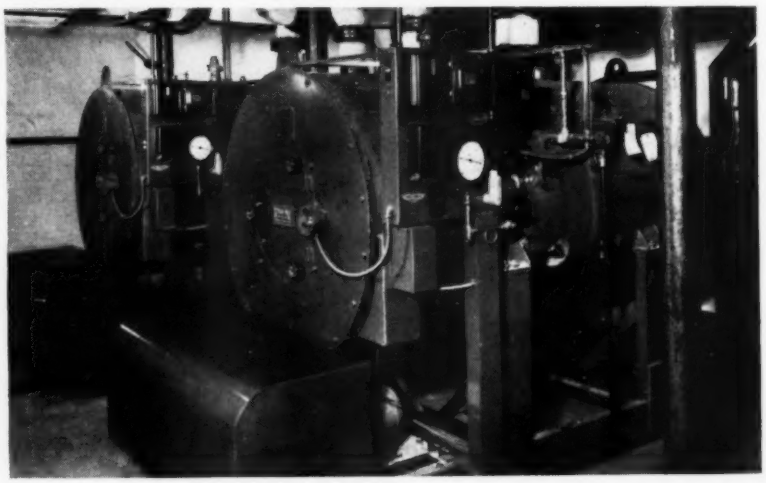
SAVE ON FUEL — with oil, gas or combination firing

SAVE ON LABOR — with a completely automatic unit

Steam-Pak Generators, similar to the one illustrated at the right have incorporated in them many exclusive features which produce automatic and highly efficient operation in producing steam.

Substantial savings result from Steam-Pak efficient 3-pass boiler construction, automatic operation with varying loads, rapid steam production and many others, including . . .

IRIS SHUTTER, the patented precise metering device which produces an even flame with practically perfect control of burner air. The correct volume of air is metered to match the firing rate. Air-oil adjustment is accurately synchronized through the entire burner firing range.



Steam-Pak Generators are built in capacities from 15 H.P. up, for low or high pressure steam or hot water, for light or heavy oil, combination gas and oil or straight gas.

Can you save money with a Steam-Pak? There is one way to find out . . . ask a qualified heating Engineer. Your York-Shipley Distributors are thoroughly qualified to analyze your problem and determine savings. See your nearest York-Shipley Distributor, or write, wire or 'phone

YORK-SHIPLEY

INDUSTRIAL DIVISION

616 Jessop Place, York, Pennsylvania — 'Phone 7861

Gas and Oil Steam-Pak Generators
Gas and Oil Vertical Boilers
Rotary Industrial Oil Burners
Oil-Fired Conversion Burners
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Oil and Gas Water Heaters
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Oil and Gas Tubeless Boiler Units
YORK STEAM POWER INDUSTRIAL DIVISION
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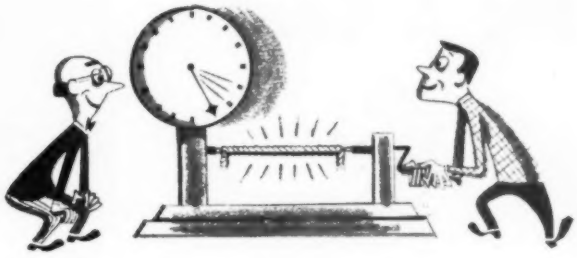
Write For Case Histories on How Others Save Money

From prehistoric times, ramie fiber has been known for its greater strength . . .

Now... Johns-Manville makes it into a packing of greater strength



That's why NAVALON lasts longer than other cold-liquid packings

LONGER PACKING LIFE . . . less down time . . . lower packing costs . . . it's the same story wherever this new Johns-Manville packing made from ramie is being used in cold liquid service.

And no wonder! Navalon has the high tensile strength inherent in ramie, strongest of all the organic fibers. It has the long-lasting, rot-resisting qualities for which ramie has been known for centuries. And it is made by an exclusive Johns-Manville process which imparts unusual lubricating properties as well—another reason why Navalon consistently outperforms other high quality packings in service against fresh and salt water, brine, cold oil and many other liquids.

If you have a tough packing problem in your plant . . . need a packing that will stand up and take it when other packings let you down, we suggest you give Navalon a try.

See your distributor today. Or send for folder PK-32A that gives further details about this new money-saving ramie fiber packing. Just fill in and mail the coupon below.

Johns-Manville
PACKINGS & GASKETS

Johns-Manville
Box 290
New York 16, N. Y.

Please send me your folder on Navalon Packing (PK-32A).

Name_____

Company_____

Address_____

City_____ State_____

IP-5

Soldering Doesn't Cost Me A Cent

"Prest-O-Lite" 5-in-1 Outfit $22.50

Since I Changed to This Outfit

Here's the way I figure it. I used to pump, prime, and generate before I could start work. Now I just turn a valve and flick a lighter. I get full heat instantly and save 5 to 10 minutes every time I light up. That's worth money . . . enough to work my new "Prest-O-Lite" Outfit for 54 minutes on an average job! By the end of a day, time saved this way has paid for all the "Prest-O-Lite" Acetylene I've burned.

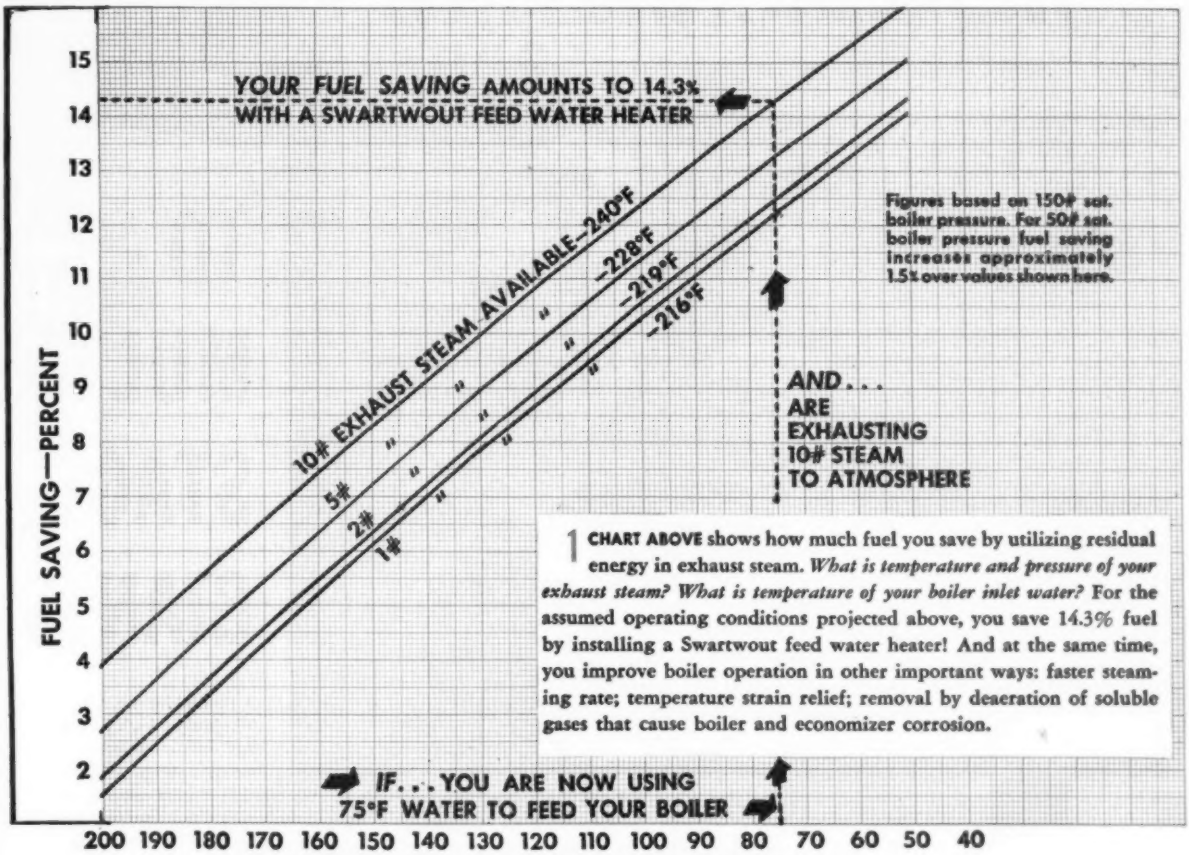
What's more, my 5-in-1 Outfit handles easily and always gives me the exact flame and heat I want. So jobs go faster, too. I figure this extra time saved pays for my solder and flux. This way, soldering doesn't cost me a cent!

Ask your Jobber or write for more details. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y. In Canada: Dominion Oxygen Company, Limited, Toronto.

"Prest-O-Lite" is a registered trade-mark of a Unit of Union Carbide and Carbon Corporation.

Order from your local Jobber

Use exhaust steam! Swartwout feed water heaters save 1% fuel for every 11° temperature rise


FUEL SAVING—PERCENT
15
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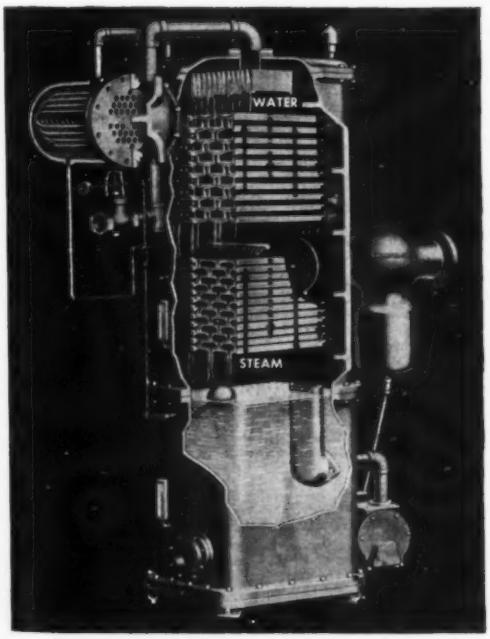
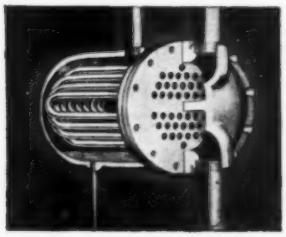
2
YOUR FUEL SAVING AMOUNTS TO 14.3% WITH A SWARTWOUT FEED WATER HEATER
10# EXHAUST STEAM AVAILABLE—240°F
5# " —228°F
2# " —219°F
1# " —216°F
Figures based on 150# sat. boiler pressure. For 50# sat. boiler pressure fuel saving increases approximately 1.5% over values shown here.
AND . . . ARE EXHAUSTING 10# STEAM TO ATMOSPHERE
IF . . . YOU ARE NOW USING 75°F WATER TO FEED YOUR BOILER
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40
YOUR PRESENT INLET WATER TEMPERATURE

1 **CHART ABOVE** shows how much fuel you save by utilizing residual energy in exhaust steam. *What is temperature and pressure of your exhaust steam? What is temperature of your boiler inlet water?* For the assumed operating conditions projected above, you save 14.3% fuel by installing a Swartwout feed water heater! And at the same time, you improve boiler operation in other important ways: faster steaming rate; temperature strain relief; removal by deaeration of soluble gases that cause boiler and economizer corrosion.



2 **COUNTERFLOW** heating and deaerating, a feature of all Swartwout feed water heaters, assures efficient removal of contaminating gases. Just before dropping into storage section, feed water is in contact only with clean steam, thereby preventing reabsorption of oxygen. Through counterflow, last traces of oxygen are removed from feed water according to law of partial pressures of gases.



3 **VENT CONDENSER** is smaller in heaters utilizing counterflow principle. Because less steam does more work, a large condenser is totally unnecessary – important from the standpoint of maintenance economy. Swartwout makes a complete line of deaerating and open heaters —from 5,000 to 300,000 lbs. capacities.

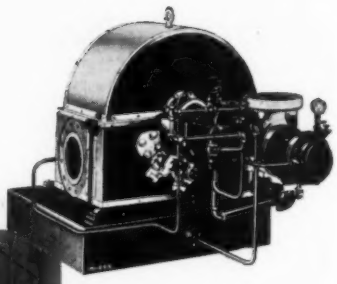
A-2675

Swartwout

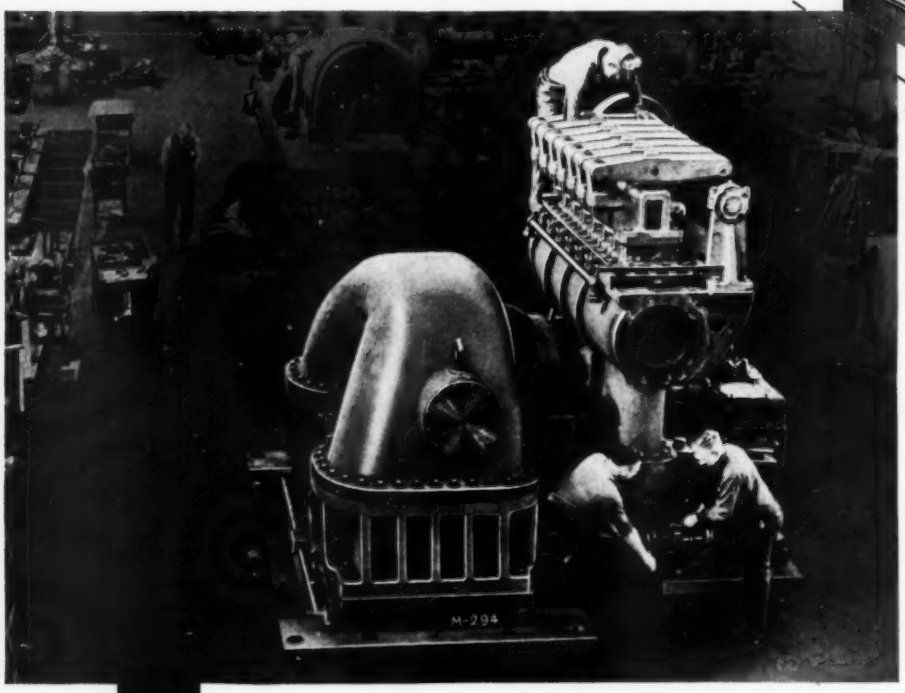
POWER PLANT EQUIPMENT

SEND FOR BULLETIN S-18-E • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

Compact, sturdy, dependable. A Worthington single-stage, centrifugal compressor-drive turbine.



FROM SMALLEST SINGLE-STAGE



TO MULTI-STAGE GIANTS

A standout for size. One of two Worthington 24,000 hp centrifugal compressor-drive turbines during assembly.

Worthington Turbines Meet the Broadest Range of Drive Requirements

Worthington Turbines offer you unlimited choice of sizes and types — including straight condensing, straight non-condensing, extraction, mixed pressure extraction, low pressure and high back pressure. Steam or gas driven, for mechanical or generator drive, all are available with governors for constant or variable speed, with optional governor-control.

LOWER-COST BLOWER AND COMPRESSOR OPERATION

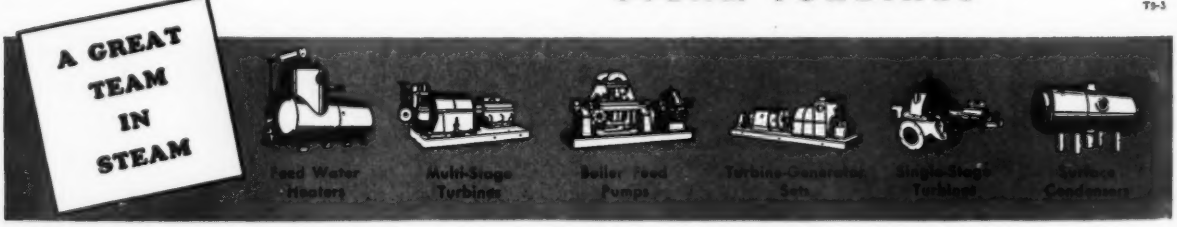
In the complete Worthington line you'll find the *right* speeds and horsepowers to keep your blowers, compressors and other mechanical drives operating at peak efficiency. And since each Worthington Turbine — from the smallest to the largest — is designed to make steam do more work, you can count on steady power- and money-saving throughout a long, trouble-free service life

Get the whole story of this economical, always dependable power from your nearest Worthington representative. Or for further facts proving *there's more worth in Worthington*, write to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y*

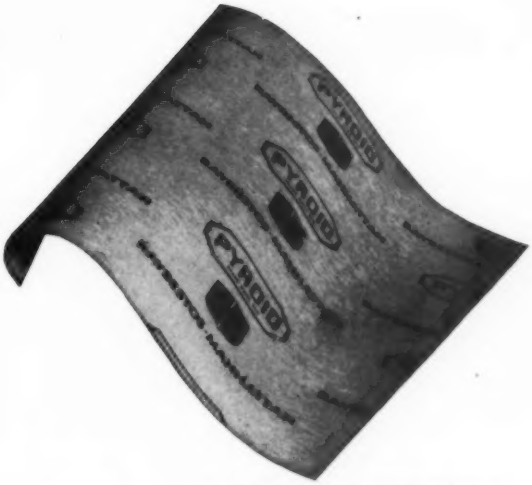
WORTHINGTON

STEAM TURBINES

T9-3



two outstanding sheet packings for long-lasting gaskets



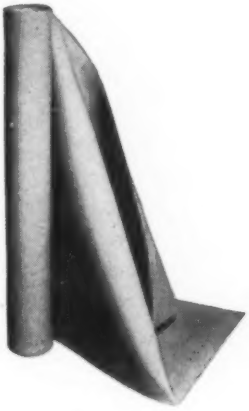
R/M NO. 650, "PYROID"

For public utilities, for power plants of all varieties, Raybestos-Manhattan manufactures a diversified line of gasket sheets that can be relied on for long, trouble-free service.

R/M "Pyroid" Compressed Asbestos Sheet Packing, No. 650, is the standard in thousands of power plants and refineries where it is called upon to resist high pressures and temperatures, and the solvent action of petroleum derivatives. A dense pliable sheet of exceptional tensile strength, "Pyroid" is made by one of America's largest manufacturers of sheet packing.

R/M No. 625 Red Rubber Sheet Packing is another widely used product. It is a tough, long-lasting resilient sheet, recommended for use against air, water, or steam at low pressures.

Other R/M sheets that have demonstrated their quality in service include R/M No. 670, a low-cost compressed asbestos sheet approved by the National Board of Fire Underwriters for use with gasoline, benzol, etc.; R/M No. 635, a Flexlastic C.I. sheet for cold water, low pressures, and general service; R/M No. 645, a diaphragm sheet of high-tensile square woven duck, covered with best grade Flexlastic and widely used in water, oil, air, and gas damper regulators. These and many others are manufactured by R/M to solve your gasket problems.



R/M NO. 625

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn. • Manheim, Pa. • No. Charleston, S.C. • Passaic, N.J.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels
Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Powdered Metal Products • Bowling Balls

I-60

Raybestos-Manhattan, Inc.
Packing Division, Manheim, Pa.

Gentlemen: Please send me data on "Pyroid" and other R/M sheet packings.

Name _____

Position _____

Company _____

Address _____

City _____ Zone _____ State _____

Flanged bonnet, welding end, high pressure, gate valve.

WHEN YOU WANT

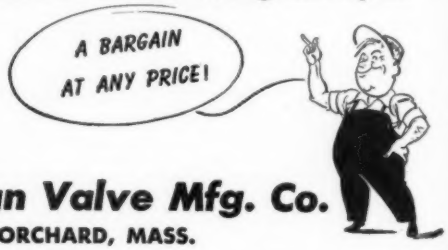
BOTH Precision and Economy

Specify CHAPMAN STEEL VALVES

Want valves with precision ratings that equal or exceed standard specifications? Then specify Chapman Valves. You'll find them the equal of custom-made valves *every time.* Yet they are economical — with the economy that comes from production line manufacture.

You'll find it will pay to specify Chapman valves for every power plant need . . . for longer service, for better service, for lower maintenance.

Available in three types of body and bonnet connections — welded, pressure sealed or flanged. Also in gate, globe, angle, or check types. Welding end valves available in globe as well as in tilting disc styles.



The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASS.

ELGIN Double Check WATER SOFTENER

Your BEST BUY on ALL COUNTS

Of course the foremost reason for installing an Elgin "Double-Check" Water Softener is its proved ability to deliver up to 44% more soft water than other softeners of the same size using the same type of zeolite.

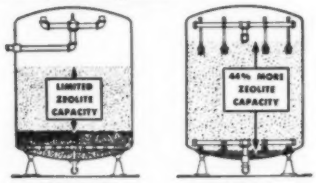
But even if it were not ahead of other zeolite softeners on this count, it would still be your best buy on the solid basis of quality construction which together with conscientious servicing when required, maintains every Elgin installation at peak efficiency. Here is why Elgin is the best buy on all counts:—

1 DESIGN

Double-Check principle gives you up to 44% more soft water

Yes, the "Double-Check" design gives you up to 44% more soft water from the same size softener using the same type of zeolite — proved in thousands of installations.

It does this because the "Double-Check" manifold system prevents the escape of zeolite and thus permits using a larger amount of zeolite in a given-size tank. More zeolite means more water softening of course. Preventing its escape also permits faster, more thorough back-washing; assures more effective regeneration; reduced salt consumption; higher efficiency; maximum economy. The two diagrams below tell the story of this revolutionary development.



ORDINARY DESIGN — ELGIN DESIGN

Same Size Units . . . Same Type Zeolite

2 QUALITY

Better construction means more years of low cost operation

When you examine the present-day Elgin you find that we have put not only advanced design into it, but also higher quality and finer workmanship.

There is none of the assembled, thrown-together construction that is too prevalent today; no skimping of materials. Instead you find well designed, Elgin-built components that assure longer life and trouble-free operation. Contrast the precision-built Elgin Multiport Valve, "Double-Check" Manifold, Backwash Regulator, with the construction found in other softeners and you will know how much more real value you get in the Elgin.

Thanks to elaborate tooling and modern streamlined production methods you pay no more for the higher quality of the Elgin "Double-Check" Softener.

3 SERVICE

Elgin servicing maintains top efficiency

Complete, capable service has always been an important plus factor with Elgin. Our interest never ends with the sale. Through the years it has always been our established policy to keep every Elgin installation operating at peak efficiency and to aid the operator in obtaining greatest benefits from its use. Elgin's service program, now better than ever, has been placed on an organized, concrete schedule which assures your realizing the outstanding performance which every Elgin product is designed to give.

"DOUBLE-CHECK" CAN BE APPLIED TO YOUR PRESENT SOFTENER

Existing softeners of any make can be modernized to incorporate the features and advantages of the Elgin "Double-Check" principle. Many modernization jobs equipped with "Double-Check" and Elgin high capacity zeolites have stepped up capacity 3 to 10 times.

Write today for facts about the softener that is ahead on all counts

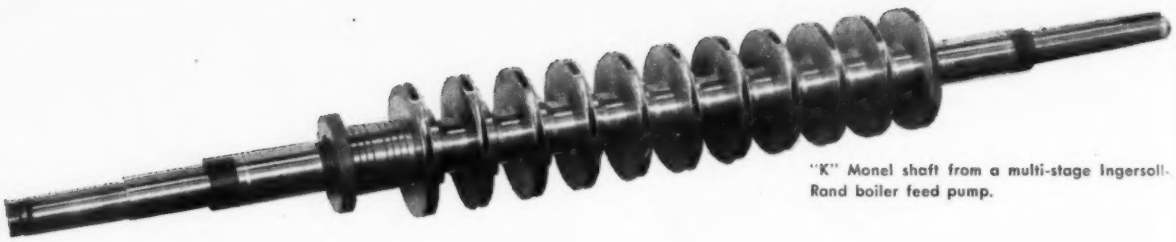
ELGIN SOFTENER CORPORATION, 138 N. Grove Ave., Elgin, Ill.

ELGIN ECONOMICAL WATER CONDITIONING

Put your water conditioning up to the Elgin man

Unlike the man who deals with one or two conditions, the Elgin District Engineer can select the best method from *all* methods. For Elgin methods include:

- Boiler feed water treatments
- Post treatments for softener water
- Corrosion prevention in steam systems
- "Deconcentrator" for removing boiler sludge
- Corrosion prevention in hot and cold water piping
- Filters and purifiers
- Iron removal systems
- Aerators and degasitors
- Chemical feeders
- Water testing apparatus
- Zeolites of all types



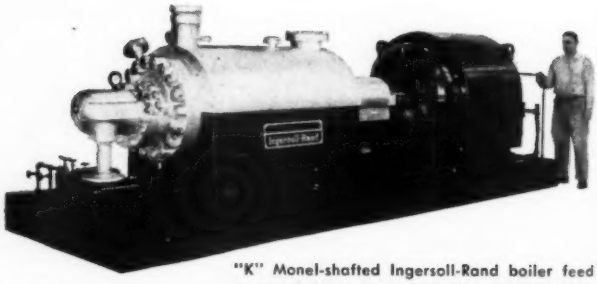
"K" Monel shaft from a multi-stage Ingersoll-Rand boiler feed pump.

"K" MONEL FOR PUMP SHAFTS...

Corrosion-resistant? *Yes!*

Heat-treatable *after* machining? *Yes!*

Strength and hardness close to alloy steel? *Yes!*



"K" Monel-shafted Ingersoll-Rand boiler feed pump of the type used by the American Gas and Electric Company System. Manufactured by *Ingersoll-Rand* Company, Phillipsburg, N. J.

"K" Monel . . . an alloy that may be heat-treated to attain maximum properties . . . has several important qualities that recommend it particularly for pump shafts.

In many pump designs, the shaft must be long and thin, yet capable of withstanding extreme loading as well as highly corrosive conditions. This combination of design factors demands a shaft metal that possesses high strength and hardness, unusually high resistance to corrosion, and high resistance to corrosion-fatigue.

"K"® Monel meets these requirements successfully, and in addition offers the advantage that it may be heat treated for high strength and hardness *after* machining without undue distortion.

Typical installations of "K" Monel-shafted pumps are those of the American Gas and Electric Company System. At three central stations, located in West Virginia and Indiana, a number of Ingersoll-Rand multi-stage pumps are used for boiler feedwater injection.

These pumps operate against a boiler pressure of 2000 psi and higher, and handle water at an average temperature of 304°F. Each pump delivers 1100 gallons per minute at a total dynamic head of 6000 feet.

These severe conditions demand a shaft metal that is strong, wear-resistant, and corrosion-resistant. Heat-treated "K" Monel has proved entirely satisfactory in this service.

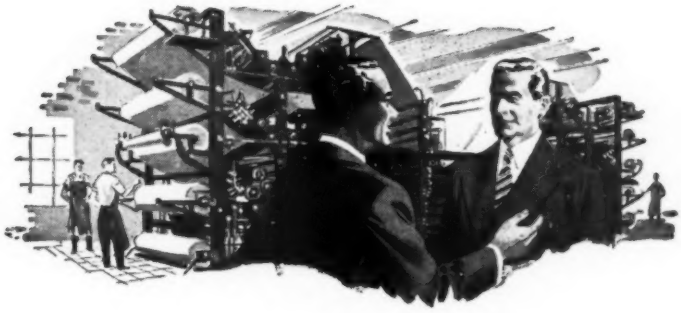
If you are concerned with pump purchase or maintenance, you will be interested in "*How to get longer life from your pumps.*" Write to R. F. Johnson of INCO for your free copy.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
NICKEL INCO ALLOYS
TRADE MARK

Monel® • "K"® Monel • "R"® Monel • "KR"® Monel • Nickel "D"® Nickel • "L"® Nickel • Inconel® • Duranickel® Permanickel® • Inconel "X"®

How to Cut a Production Expense *from $14 Daily to* 21 cents!



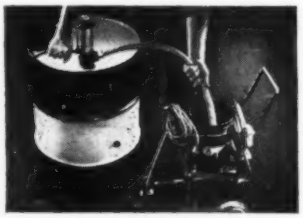
This represents a saving of over $3000 every year to a Clinton, Mass. company.* It was made possible by solving the kind of problem that may be cutting profits—daily—in YOUR plant, too!

A survey of plant methods revealed that machines had to be stopped a half hour in every 8 hour day, for lubrication. Could this $14-a-day expense be trimmed? An Alemite Lubrication Engineer recommended a system that lubricates all machines automatically while they're running. The result—lubrication cost was cut to only 21 cents a day! And this saving alone paid for the whole investment in 43 days!

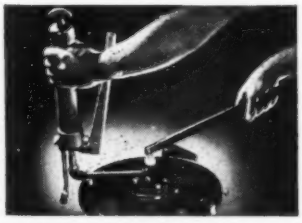
No matter what size or type of plant you operate, Alemite can show you dozens of ways to make worthwhile savings through more efficient handling of petroleum products. These are facts which you can readily confirm in your own time studies. Contact your local Alemite Industrial Distributor now. Or send for free booklet "11 Ways to Cut Production Costs." Simply attach coupon below to your letterhead. Alemite, Dept. M-60, 1850 Diversey Parkway, Chicago 14, Ill.

**Name on request*

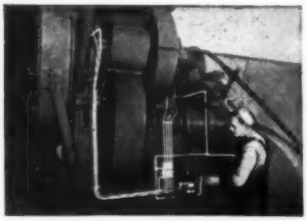
Alemite Cuts Costs 3 Ways



1. ***In Transferring Lubricants...*** by eliminating mess, expensive contamination—and cutting man hours 63% for every 100 pounds of lubricant transferred.



2. ***In Loading Grease Guns . . .*** by saving 3¾ man hours for every 100 pounds of lubricant loaded into hand guns.



3. ***In Applying Lubricants . . .*** by saving up to 23.9 man hours for every 100 pounds of lubricant applied to bearings.

ALEMITE

MEANS EVERYTHING FOR LUBRICATION

1. Methods 2. Lubricants 3. Equipment

Another Product of Stewart-Warner

FREE! New Booklet—
"11 Ways to Cut Production Costs"...
(simply attach to your letterhead)

Alemite, Dept. M-60
1850 Diversey Parkway, Chicago 14, Ill.

Please send me without charge or obligation your booklet "11 Ways to Cut Production Costs."

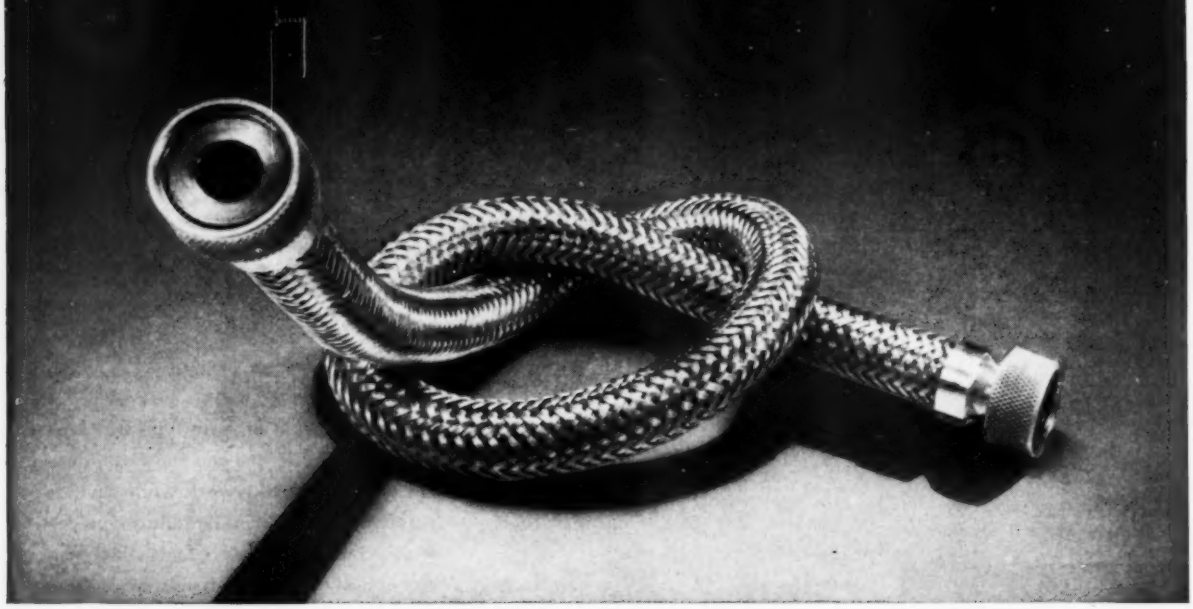
Name _____

Company _____

City _____ *State* _____

this is CMH REX-FLEX

flexible stainless steel hose



While the need rarely arises, tying CMH REX-FLEX into a knot does illustrate the high degree of flexibility of this *all-metal* corrugated stainless steel hose. And the same characteristics of stainless steel that make REX-FLEX so flexible also give it the ability to withstand extreme cycles of vibration, flexation and variplane motions.

Light in weight . . . high in strength . . . leak-proof . . . and highly resistant to corrosion, REX-FLEX is the answer to the problems of handling searching and corrosive liquids and gases where there is motion.

CMH REX-FLEX is made in sizes from 5/16" through 6" I.D. Wall thicknesses from .003" in single ply to .030" in multiple plies. Available with helical or annular corrugations, with or without metal braid covering. Ends may be flanged or equipped with fittings to meet your requirements. Write for complete information.

Flexon identifies CMH products that have served industry for over 48 years.

CHICAGO METAL HOSE Corporation

1335 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ont.

CMH

ONE DEPENDABLE SOURCE

for every flexible metal hose requirement

Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

NOW! AT NO INCREASE IN COST TO YOU

NEW! STAINLESS STEEL BODY

Makes a good steam trap better

Nearly 650,000 Yarway Impulse Steam Traps have already been installed—proof that they are doing a good job.

Now a *stainless steel* body makes this famous little trap even *better—at no increase in cost.*

Better in *wear*, better in *service*. Users will find Yarways require less maintenance than ever. All parts are wear-resistant, practically wear-proof. There is only one moving part, a small, stainless steel, heat-treated valve. Important, too—Yarway Impulse Traps are *suitable for all pressures up to specified maximum without change of valve or seat.*

Other popular advantages are *small size, light weight, easy installation* and *low cost.* Often it costs *less* to buy a new Yarway trap than to repair an old, ordinary trap.

In performance—ask any user. They all say Yarways are the traps that *get equipment hotter sooner and keep it hot!*

For better steam trap performance, try *new* stainless steel Yarways.

YARWAY IMPULSE STEAM TRAPS ARE SOLD BY OVER 200 DISTRIBUTORS. THERE IS ONE NEAR YOU.

Write for name and address.

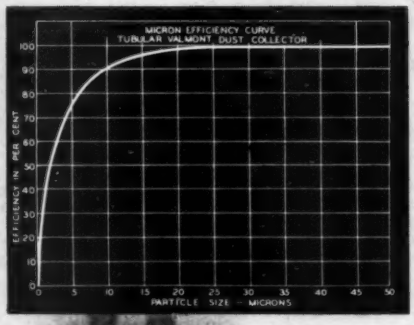
YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY IMPULSE STEAM TRAP

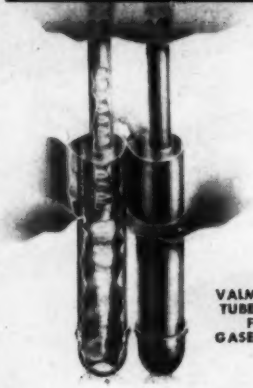
THE VALMONT TYPE S COLLECTOR

CATALOG DIGEST

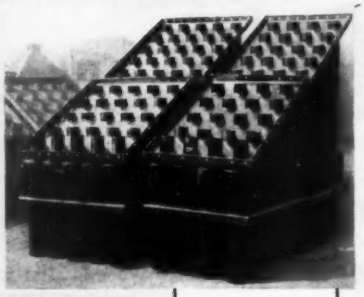
The following information is taken from the New Bulletin on P-D Valmont Type S Collector. For Complete Bulletin containing dimension tables, sizes, nomographs and suggested installation plans, write our Project and Sales Engineers.



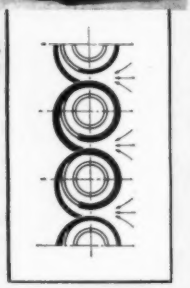
P-D EFFICIENCY CURVE



VALMONT TYPE S TUBES SHOWING FLOW OF GASES AND INLET



HORIZONTAL TYPE TUBE SHEET SECTIONS KNOWN AS "UNI-BLOCS"



METHOD OF NESTING TUBES—REDUCES TURBULENCE . . . SAVES SPACE

HIGH EFFICIENCY—The outstanding contribution to higher efficiency in the P-D Valmont Type S is the inlet slot design. A patented development of Prat-Daniel, this inlet is high and narrow, reducing the radial distance of dust-travel. To explain its effect on dust collection, we quote from Cyclone Dust Collector Design, by Melvin W. First, Paper No. 49-A-127, presented at the Annual Meeting of the American Society of Mechanical Engineers, Nov. 27—Dec. 2, 1949, page 14.

> "Entry width is an important variable in cyclone efficiency, as it controls the stream width. This, in turn, directly controls the radial distance particles must traverse to reach the cyclone wall and be separated by centrifugal force. The smaller the radial distance to be traversed, the lower the tangential velocity needed (less energy loss) and the smaller the particle that can be successfully separated for a given flow rate."

LONG LIFE—Extensive tests were made to determine the wear factor. All types of abrasive dusts were run at accelerated speeds, against various metals simultaneously and steel proved to be the most resistant to erosion.

Another long life factor is the lower velocity required due to the small tube diameter. It is a well-known fact that reduction of tube diameter produces higher centrifugal force. Thus, efficiencies are maintained at the lower load ranges.

MASS PRODUCTION METHODS—The P-D method of "uni-bloc" construction permits manufacture and assembly of sub-sections at the factory. These are shipped to the field and easily erected, either vertically or horizontally, to fit the layout. Savings in cost of erection are thus realized yet the collector is "tailor assembled" to fit the installation requirements.

SMALL SPACE FACTOR—Because of close nesting of tubes possible in P-D Valmont Type S Collectors, the space required for this apparatus is much less than conventional collectors. In many cases, P-D units have been fitted into spaces that could accommodate no other type.

The Thermix Corporation, our Sales and Project Engineers are specialists in the art of dust collection. Consult them about your dust problems.

Project and Sales Engineers

THE THERMIX CORPORATION

Greenwich, Conn.

(Offices in 28 Principal Cities)

Canadian Affiliates: T. C. CHOWN, Ltd.

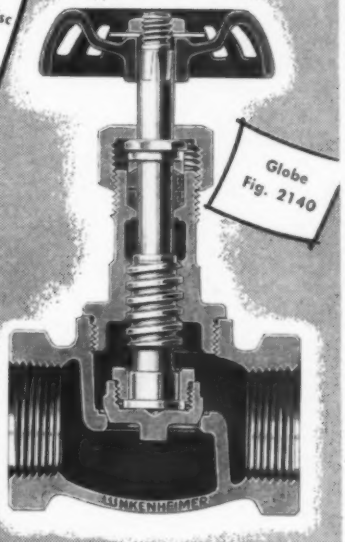
1440 St. Catherine St. W., Montreal 25, Quebec; 50 Abell St., Toronto 3, Ontario

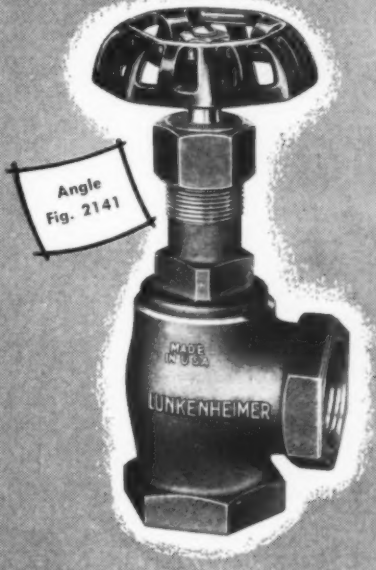
PRAT-DANIEL CORPORATION

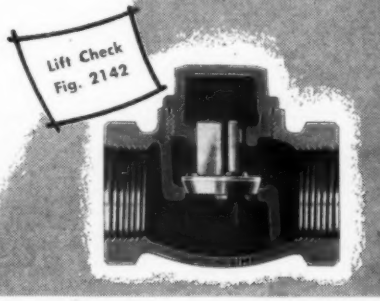
Designers and Manufacturers of Power Plant Equipment for Over 25 Years

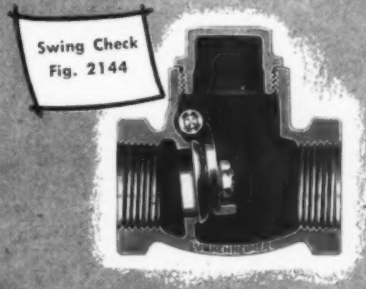
69-6 WATER STREET • EAST PORT CHESTER, CONN.

Here's economical standardization on your 125 lb. bronze valve requirements









IN THIS LINE OF VALVES you'll find just what you need to take care of your requirements for 125 lb. service. And you'll also get the inherent values that go into the design and manufacture of every Lunkenheimer product . . . the finest of materials, metallurgically tested and approved; sound engineering design; perfect alignment of parts; meticulous accuracy; craftsmanship guaranteed by skill and ripe experience; the most modern equipment to produce better, and ever better products.

It is the balanced combination of all these factors that has made Lunkenheimer the synonym of highest valve quality, and your guarantee of lowest valve cost per dollar invested.

Give any Lunkenheimer valve a chance to prove itself in service. Once installed, it will quickly demonstrate real economy. Its performance, under all conditions, will be a firm recommendation for your complete standardization on Lunkenheimer . . . and the solution of your valve problems.

Want more information on these fine 125 lb. valves? Ask your distributor for Circulars 566 and 582—or write us direct.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U.S.A.

NEW YORK 13 · CHICAGO 6 · BOSTON 10 · PHILADELPHIA 34

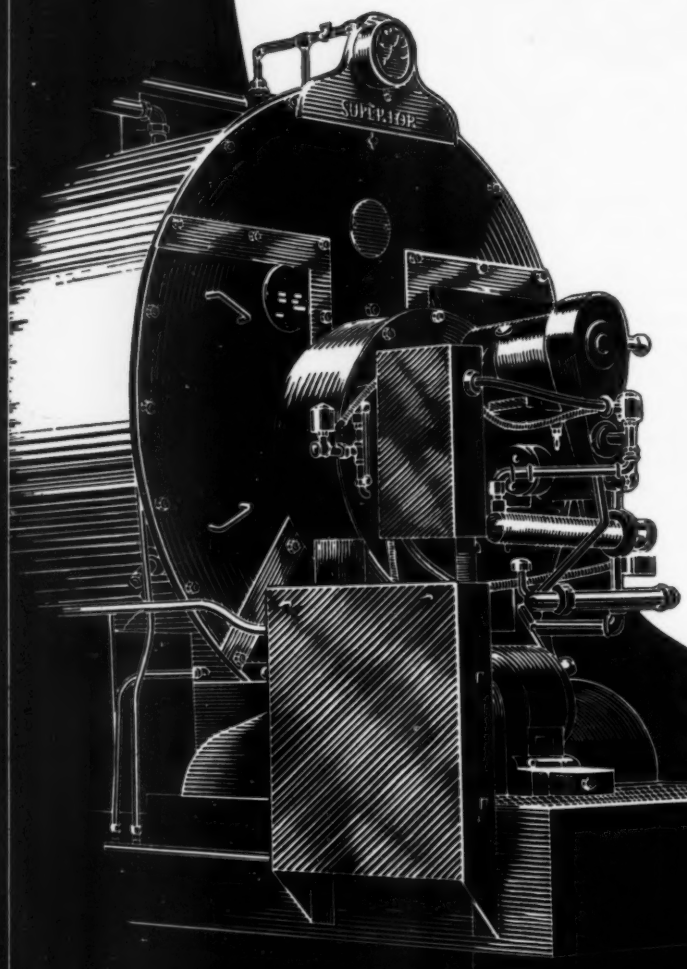
EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

Your Lunkenheimer Distributor

is stocking these 125 lb. S. P. Bronze Valves. Call upon him for your original equipment, replacement and repair valve requirements.

For STEAM DIVIDENDS Tomorrow

Buy SUPERIOR STEAM GENERATORS Today



The operating economies which result from Superior's higher efficiency and long-lived dependability pay *real* dividends to their owners. Their thermal efficiency (guaranteed to exceed 80%) insures lowest fuel costs. Their rugged, heavy-duty construction spells years of dependable, trouble-free operation.

Fuel and maintenance savings are outstanding where Superior Steam Generators have replaced older equipment . . . but the greatest dividends result where Superior Steam Generators are specified for new steam plants. For here are added to their economy of operation (1) the economy of small space, (2) the elimination of an expensive stack (for Superior's induced draft requires only a vent for the products of combustion), and (3) simplified installation resulting from Superior's complete factory assembly and wiring.

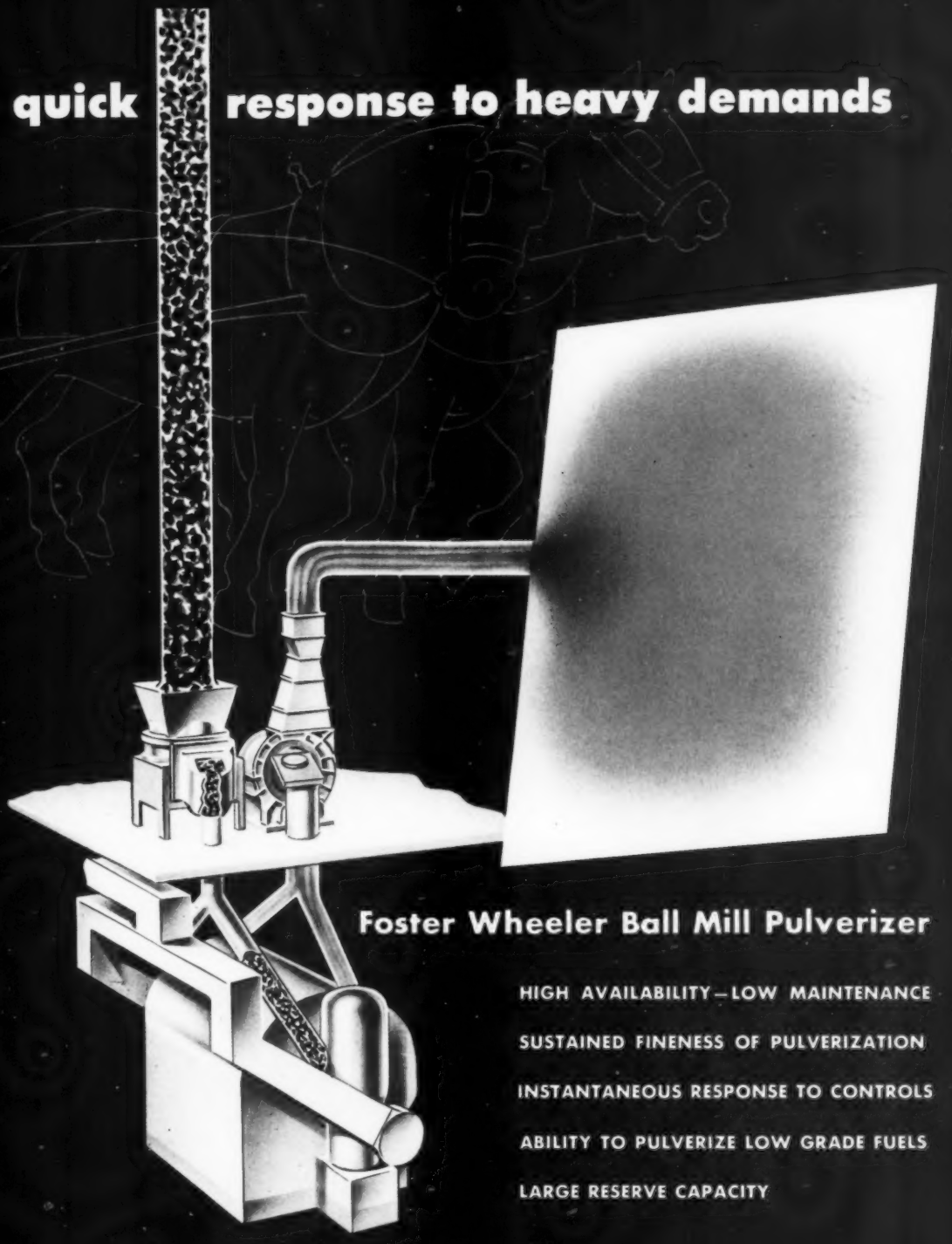
There'll never be a better time to buy a Superior Steam Generator . . . because these dividends start with the first day's operation, and every day thereafter adds its dividend.

17 sizes from 20 to 500 b.h.p. for pressures up to 250 p.s.i. Fully automatic with all grades of oil or gas. For complete data write for Catalog 202.

uperior ombustion ndustries, inc.

Factory Emmaus, Pa
Executive Offices Times Tower, Times Square, New York 18, N. Y.

quick response to heavy demands



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HIGH AVAILABILITY—LOW MAINTENANCE

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INSTANTANEOUS RESPONSE TO CONTROLS

ABILITY TO PULVERIZE LOW GRADE FUELS

LARGE RESERVE CAPACITY

The basic qualities of dependability, responsiveness, and capacity for hard work . . . as symbolized by the prize workhorse . . . are also desirable in modern machinery. But it is the added element — *skilled engineering* — that removes us so distantly from the horse age and makes it possible to build machinery like the Foster Wheeler Ball Mill Pulverizer which pulverizes as much as 30 to 40 tons of coal per hour with instantaneous response to load demands.

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a small unit with a great background

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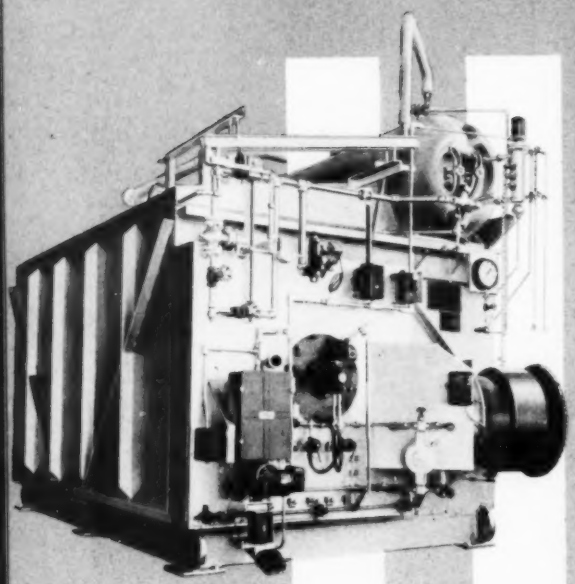

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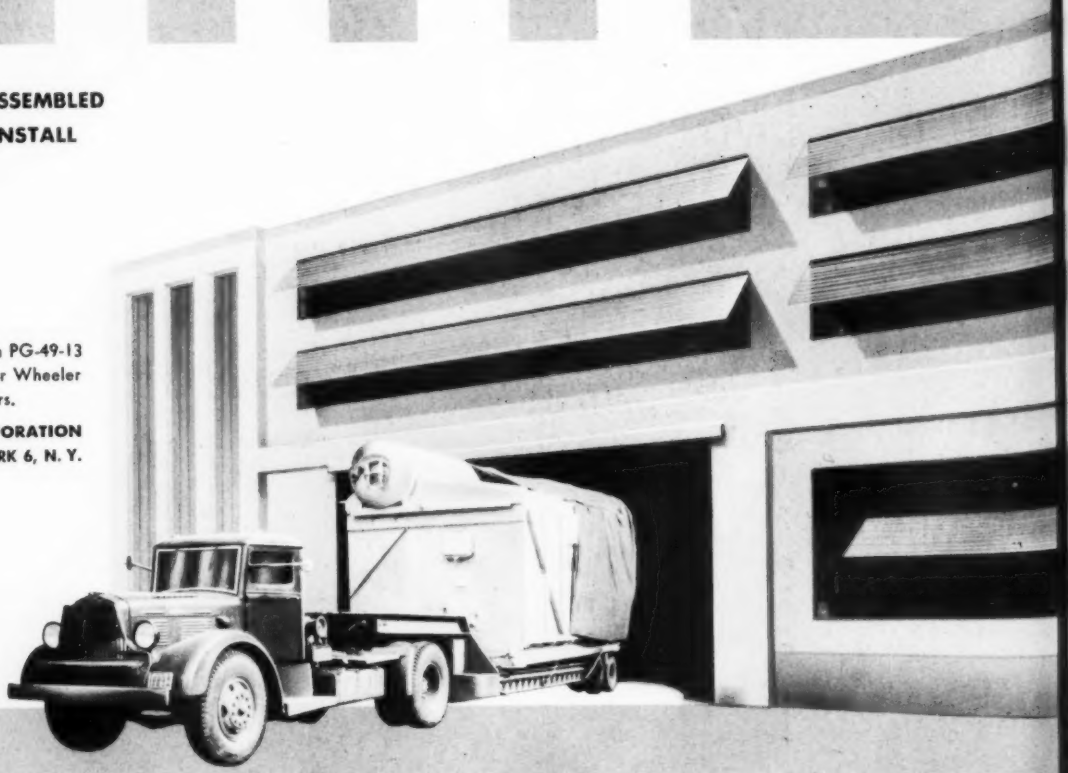

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INDUSTRIAL POWER

June, 1950 Vol. 58, No. 6

MONSANTO BUILDS STEAM PLANT AT

First high-pressure unit of multiple-boiler power plant has been installed. Although it is now operated at low pressure to meet process-steam demands, it will ultimately be put on the line to generate byproduct electric power. Reliability of operation and certainty of future expansion dictated auxiliary units of double boiler capacity

Comprehensive combustion control equipment keeps boiler at top efficiency, and maintains process-steam demands

ROBERT SCHAFFNER, Power Superintendent
Merrimac Division, Monsanto Chemical Company

ONLY INFREQUENTLY does an industrial plant have occasion to build a new steam-generating station from the ground up, unencumbered by previous construction. Hence, when such an opportunity arose, Monsanto Chemical Company engineers built into their new Everett, Mass., boiler plant their most forward thinking, which at the same time was consistent with conservative industrial boiler-plant design.

During the postwar period, Monsanto's Merrimac Division at Everett realized its plans to produce new and improved chemicals for the textile industry. Estimates of future utility requirements made it obvious that existing steam-boiler capacity would be inadequate. Therefore, plans included increased steam-production facilities.

Part of the steam at Everett is obtained from waste heat provided from various chemical processes. Of the average winter load in effect at the time preliminary studies of the new plant were made, approximately 30% was furnished by waste heat. However, as these process units are liable to be shut down at any time, the main boiler plant must be capable of carrying the total plant load.

The total peak capacity of the old boiler plant was 129,000 lb per hr. To obtain this peak, it would have been necessary to operate the five existing old boilers in excess of 200% of their rating.

Before launching into plans for new steam-producing facilities, public utilities operating power plants in the vicinity were asked if they would furnish any or all of Monsanto's process steam. They were not equipped to do so; therefore, the power section of the general engineering department of Monsanto was requested to make a study and submit recommendations.

After many alternate schemes were considered, it finally proved advisable to lay out a completely new power plant and construct the first unit —a single-boiler plant. This decision was based on the following factors: (1) the age and condition of the old boilers, (2) the relatively congested area where they were located, (3) the fact that they were far removed from the load center of the factory, and (4) a nearly ideal location in an undeveloped area was available. Therefore, the designers were unrestricted, except in regard to the preliminary cost estimate that had been approved by management in designing the ideal boiler installation.

Plant Design

The building is simple, functional and modern in appearance, a style which lends itself well to economical construction. The fact that the ground grade at this location is only a few feet above tidewater dictated that the boiler and equipment be placed above ground. Because of this, and the extreme height of modern boilers, the building of the first unit has severe vertical lines. These, however, were satisfactorily broken up by horizontal

bands of windows, which are functionally located to provide light and ventilation within the building. Three walls of the building are constructed of second-hand brick for pleasing effect and durability; the fourth is hollow tile so the building easily can be extended.

The boiler occupies the major portion of the building. It is a completely insulated and steel-encased two-drum unit with a water-cooled hopper-bottom furnace. The unit was designed for high-pressure operation in line with Monsanto's policy to generate by-product electric power when it can be justified economically. This, therefore, is the first unit of an ultimate multiple-boiler power plant, and has been designed accordingly.

Symmetry of Layout

An interesting feature of this boiler installation is its symmetrical layout. There are two independent combination oil and pulverized-coal burners with separate coal feeders, pulverizers and controls; two induced-draft fans located at the rear of the boiler on the operating floor; two forced-draft fans located on the ground floor below the induced-draft fans.

One departure from symmetry, for the sake of reliability and economical heat balance, provides for one of each of the fans to be turbine driven; the others are motor driven. The induced-draft fans exhaust directly into the base of a 5-ft dia steel stack that extends through the roof of the building to a point 101 ft above the ground. The forced-draft fans take the air for combustion directly from the building, so that by proper manipulation of the windows adequate ventilation is provided.

As a result of study of boiler-plant layouts made by the designers, it was concluded that for economy and reliability it would be most satisfactory to design this type boiler plant around units of two boilers. Therefore, in this first single-boiler unit, all the major auxiliary equipment was designed for double the boiler capacity.

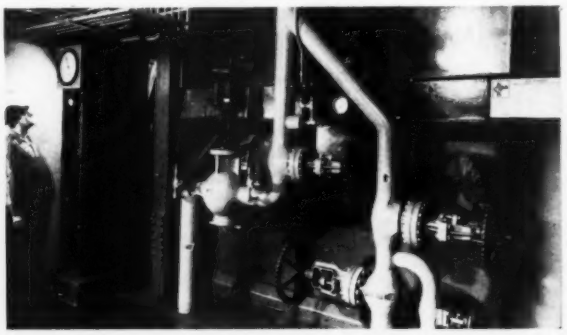
The coal-handling equipment, however, was laid out to provide for the ultimate plant. This departure from the basic design was due to economies gained by confining the relatively large and expensive coal-handling equipment to one area. This equipment is capable of receiving run-of-mine coal from either railroad cars or trucks.

A single bulk-flow elevator system with a capacity of 35 tons per hour was provided and space allotted for a future parallel unit. A ring-type crusher was installed below the unloading hoppers to reduce the size of the run-of-mine coal to the minus ¾ in. required by the pulverizers. This crusher was sized to be capable of feeding both the present and future elevators. The coal-storage bunker is located above the operating floor and has a capacity of approximately 260 tons, or three days' supply at full boiler load.

Oil was originally included as an alternate fuel because, at the time the unit was designed, the fuel situation was very unsettled—bunker "C" fuel oil was scarce. However, this condition has since changed and the unit has been operated entirely on oil.

Oil is stored in two 30,000-gal semi-buried tanks, with a 5,000-gal pump tank provided to transfer the oil from tank trucks. Two fuel-oil pumps—one steam, the other electric driven with a two-speed motor—are installed on the ground floor to transfer the oil from storage to the burners. A large fuel-oil heater is used so that low-pressure exhaust steam can be used uncontrolled to heat the fuel oil; this not only eliminates the need of a temperature control, but also forestalls carbonization of oil in the heater. Edge-type filters

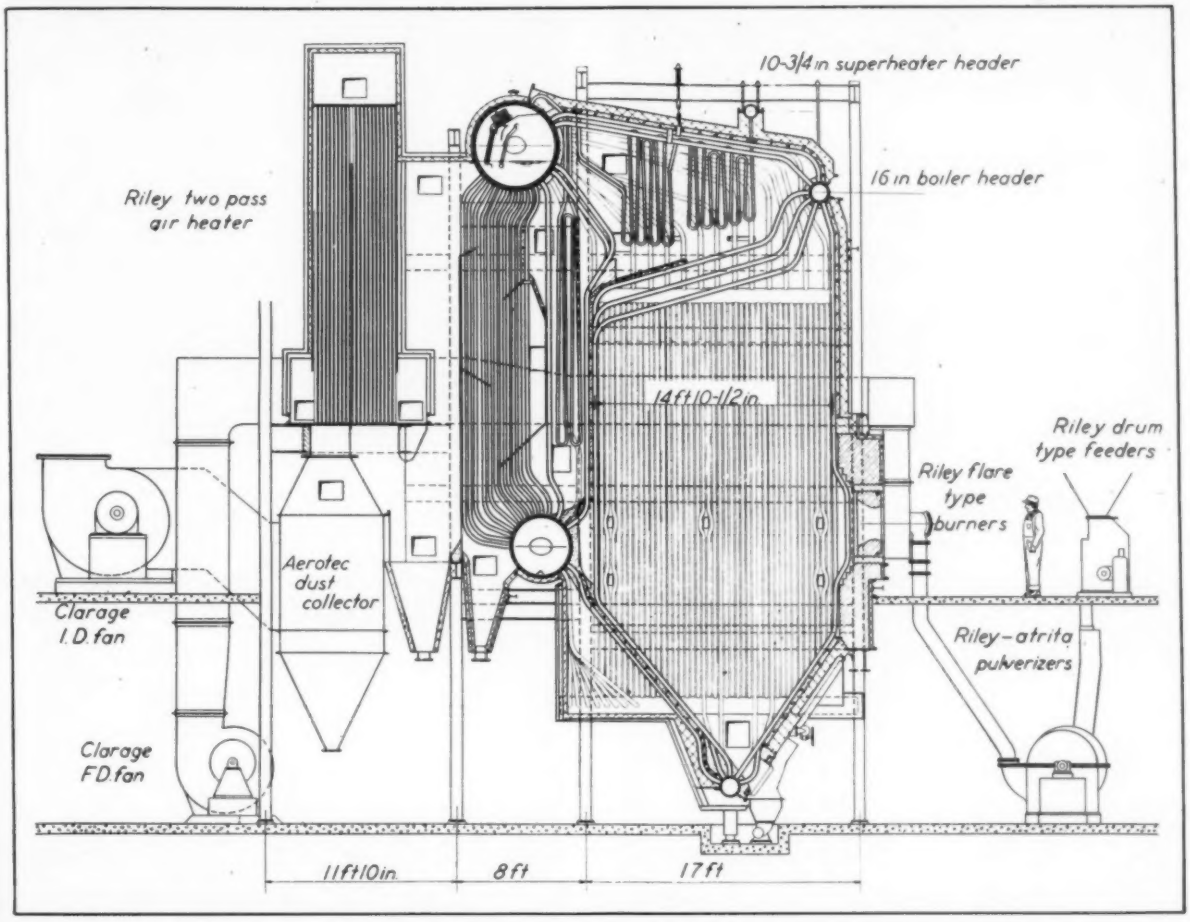
In this view of the firing aisle are seen the combustion control panel in the right foreground, the auxiliary panel in the background, and the magnetic-separator panel board for the pulverized-coal feeder in left foreground



Automatic boiler feedwater control valve is located on the left-hand side of the boiler. Bypass valves in the foreground are manually operated in case automatic operation fails. Auxiliary boiler pressure gage is in the background

Fuel oil regulator valves are located on the right-hand side of the boiler. Directly under fireman's hand is the automatic oil trip valve that operates should draft fail; it is hooked to the boiler and combustion control boards

Boilers are fired by combination oil and pulverized-coal burners. With oil, wide-range mechanical atomizers are used for normal loads, and steam atomizers for low loads. Tertiary air duct cools coal nozzle when firing with oil



Boiler is a steel-encased, two-drum, 980-psi unit with water-cooled, hopper-bottom furnace, designed to burn either pulverized coal or oil. Boiler heating surface 7,580 sq ft; water-wall area 3,000 sq ft; air-heater surface 11,900 sq ft; furnace volume 4,500 cu ft. Continuous capacity is 75,000 lb per hr at 875 psi and 825 F at superheater outlet with 375 F feedwater when burning coal. Oil-fired capacity under same conditions is 100,000 lb per hr. Over-all operating efficiency at initial operating conditions of 225 psi and 450 F at superheater outlet is above 85% on either fuel

PRINCIPAL EQUIPMENT IN MONSANTO'S BOILER PLANT, EVERETT, MASS.

Boiler	Riley Stoker Corp.
Forced-draft fans	Clarage Fan Co.
Induced-draft fans	Clarage Fan Co.
Deaerating feedwater heater	Graver Water Conditioning Co.
Boiler feed pumps	Worthington Pump & Machinery Corp.
Combustion control	Bailey Meter Co.
Fuel-oil pumps	Worthington Pump & Machinery Corp.
Coal pulverizers	Riley Stoker Corp.
Coal-conveying system	Stephens-Adamson Mfg. Co.
Ash conveyor	United Conveyor Corp.
Salt-water pump	Gardner-Denver Co.
Air compressors	Ingersoll-Rand Co.
Dust collectors	The Aerotec Corp.
Clear-water pumps	Goulds Pumps, Inc.
Condensate and blowdown heat exchangers	Ross Heater & Mfg. Co.
Chemical feed pumps	Milton Roy Co.
Power transformer	Westinghouse Electric Corp.
Fuel-oil transfer pump	De Laval Steam Turbine Co.
Fuel-oil transfer pump	Geo. D. Roper Corp.
Fuel-oil filters	Cuno Engineering Corp.
Fuel-oil heater	Griscom-Russell Co.
Fuel-oil temperature recorder	Bailey Meter Co.
Header valves	Walworth Co.
Pressure-reducing valves	Mason-Neilan Regulator Co.
Pressure-reducing valves	Fisher Governor Co.
Feedwater control	Bailey Meter Co.
Temperature recorders	Leeds & Northrup Co.
Flowmeters	Republic Flow Meters Co.
Flowmeters	Bailey Meter Co.
Boiler non-return valve	Edwards Valves, Inc.

are installed ahead of the control valves in the fuel line to the burners. Mechanical wide-range oil atomizers are used in the combination pulverized-coal and oil burners.

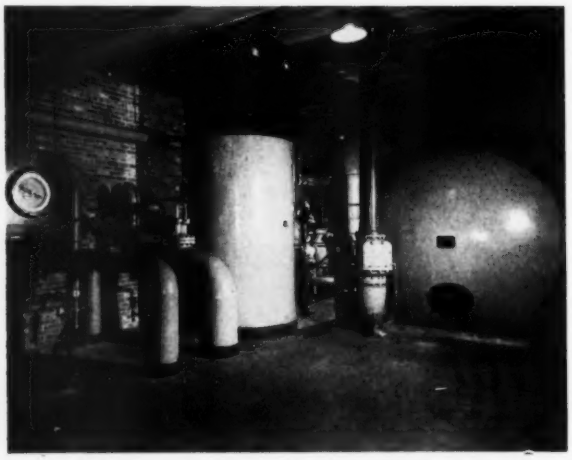
100% Feedwater Makeup

The feedwater system was designed with a maximum capacity of 250,000 lb per hr. Two turbine-driven and one motor-driven boiler feed pumps, each with a capacity of 300 gpm at 350 psi, are located adjacent to the operating aisle. Water comes to these pumps at approximately 220 F from a deaerating heater that reduces the oxygen content of the water below 0.005 cc per liter. The heater has a storage capacity of 4,125 gal, which is approximately 20 min supply at full load for one boiler.

Particular attention is given to the boiler feedwater because outage due to tube failures cannot be tolerated. A complete condensate recovery system, located throughout the factory, returns a major portion of the steam condensate to the boiler plant. However, since water from the local municipal supply is quite soft and low in dissolved solids, and the condensate returns may

In this view are the motor-drive for FD fan (left), and turbine-drive for the FD fan (right); in background, the fly ash collectors and flyash vacuum lines to sluice system

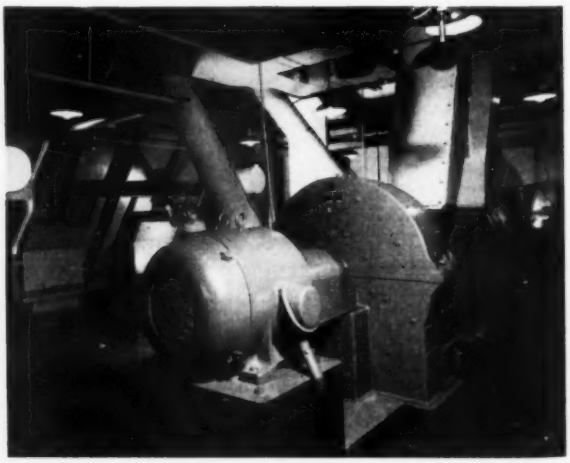
This air compressor is one of a pair that supplies air for instruments on the combustion control panel board. Operator stands in front of chemical-feed control panel



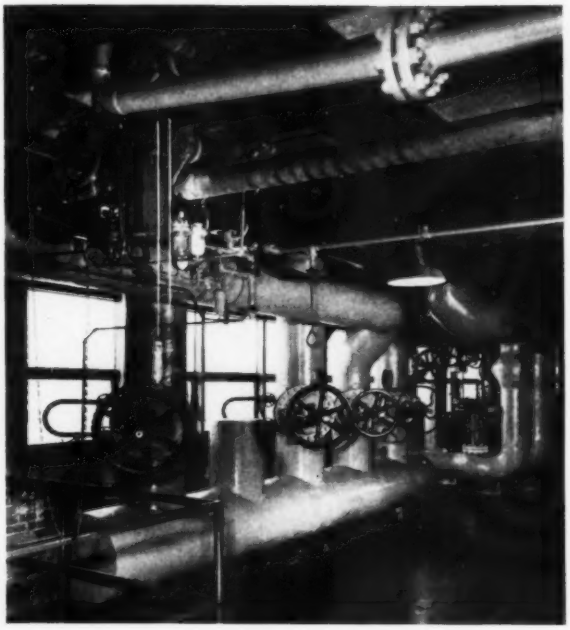
Condensate and blowdown valves located between deaerator (right) and base of stack (center). Left: 60 to 5 psi reducing valve in low-pressure line to boiler auxiliaries

Fuel-oil pumps (foreground), the fuel-oil heater (background), and clear-water feed pump supplying water to bearings and boiler-plant auxiliaries are shown here

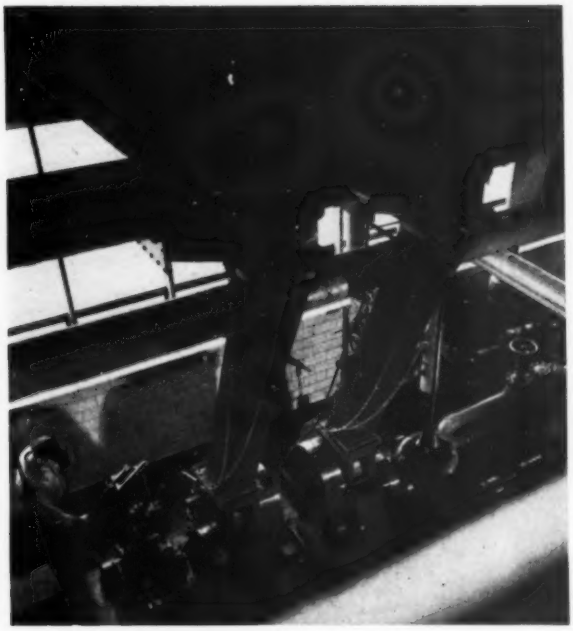
Reciprocating coal feeder (top) brings coal from freight cars to crusher (center). Crushed coal, 3/4-in. size, is taken to top-floor hopper by vertical and slope conveyors



Pulverizers in basement are directly below coal feeders on the firing floor. They crush 3/4-in. coal to firing dust. Furnace ashpit and cleanout doors are in background



Main header that supplies high and low pressure steam for factory processing and heating, and for boiler auxiliaries. In the background is seen the 200/60 psi reducing valve



Coal chutes leading from main coal hopper on the top floor to the pulverized coal feeders. Feeders regulate coal supply to the pulverizers according to boiler load

become contaminated with chemicals from the process units, 100% raw water is used as makeup; condensate is passed through a heat exchanger to preheat the makeup, and is then discharged to the sewer.

Cooling water required by the various pieces of auxiliary equipment in the boiler house is supplied from the fresh-water system, and is returned to a pump tank from which it is pumped through a second heat exchanger to the deaerator. This heat exchanger performs the dual function of extracting the heat from the boiler continuous blowdown and condensing the exhaust steam from the control-system air compressor.

Feedwater to the boiler is controlled by a three-element system for close regulation of water level. The vaives are located adjacent to the firing aisle so they may be easily checked or operated manually in an emergency.

Internal chemical treatment of the feedwater is used with a solution of meta-phosphate and caustic being pumped directly into the boiler drum at timed intervals; quantities are regulated automatically by the feedwater flowmeter. A solution of sodium sulfite and caustic is pumped continuously into the feedwater line at the outlet of the deaerator. This removes the last traces of oxygen from the feedwater, and adjusts its pH to approximately 8.5 to protect the feed lines and pumps against corrosion.

A laboratory is provided on the operating floor for use by the watch firemen in analyzing the feedwater for control of the chemical treatment.

Hydraulic Ash Removal

A hydraulic-type ash-conveying system is used for removing ash from the furnace bottom. There is a companion hydro-pneumatic system for handling the flyash from the rear-pass hoppers and the flyash collector. The ash system is operated by salt water pumped from the plant mains by a booster pump operating at 100 psi. The ash is conveyed to a settling basin through an 8-in. pipeline.

The flyash collector is of the multicyclone type made up of 720 cast-aluminum miniature cycle separators. This unit is designed to remove 91% of the flyash over 10 microns in the flue gas when operating with coal. The unit is so efficient that, while operating on fuel oil, and with apparently smoke-free operation, large quantities of soot and flyash are collected and the hoppers must be emptied daily.

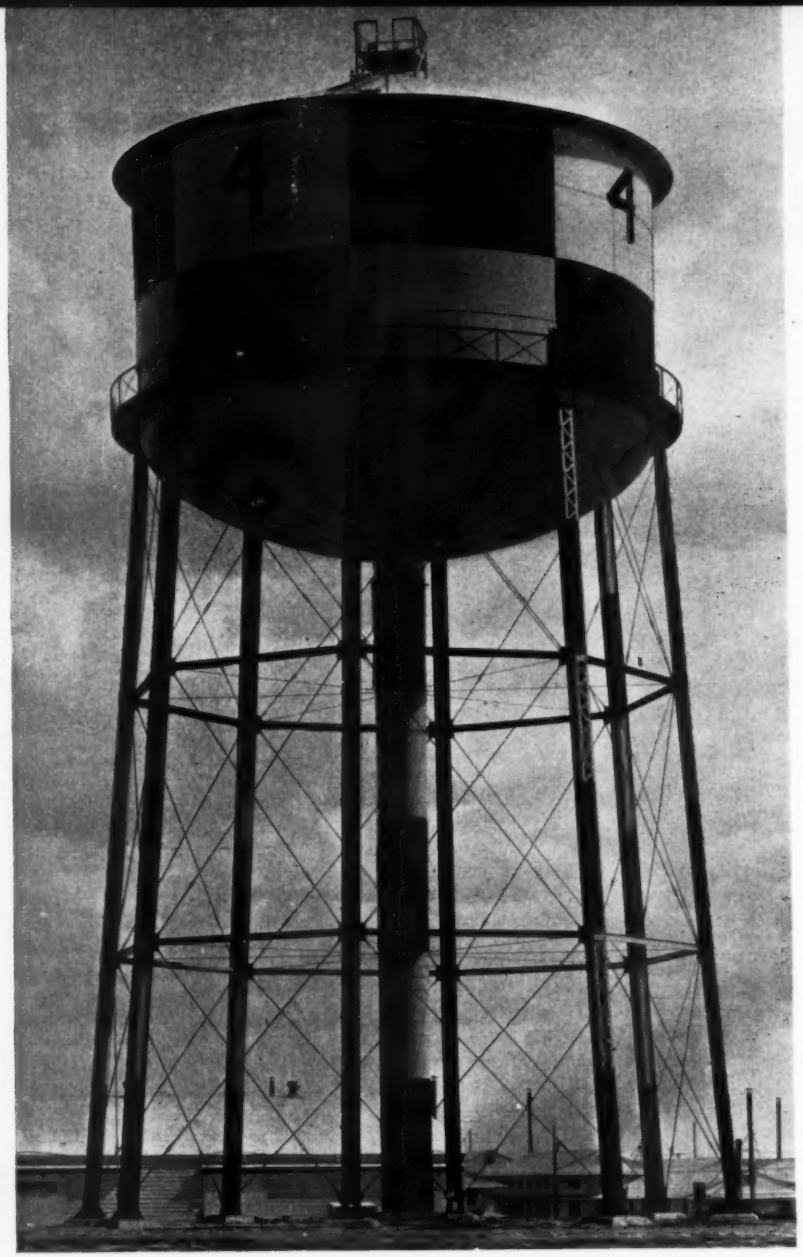
Combustion Control

To follow the varied steam demands of the diversified processes of the Everett plant, as well as maintain the constant pressure required by those processes, and at the same time keep the boiler operating at peak efficiency, a very comprehensive combustion control system is provided. The heart of this equipment is the panel on which all the major functions are coordinated. The control setup is somewhat complicated due to the dual fans with both turbine and electric drives. The controlling equipment is so devised that each controlled function can be operated either automatically or manually from the control panel by air; also, by hand at individual drives in case of control-air failure. Both steam-driven and electric-driven air compressors provide the reliable source of control air needed to operate this plant.

Electric-eye flame alarms are installed at each burner to warn the operator of insufficient or excess fuel. It is interesting to note that these units operate quite successfully as a smoke alarm to aid the firemen in abiding by Monsanto's policy of strict smoke abatement. A low-air-flow contactor is included as another combustion safeguard; it shuts off the fuel at the minimum air flow for safe combustion. This prevents unsupervised relighting of the fire should it become extinguished due to low-air operation.

Because of the high cost of fuel and utilities in the area where this plant is located, every effort must be made to maintain efficient distribution and economical use of the utility services. For this purpose, and for accurate cost accounting, complete metering is carried out throughout the chemical processes by the power department. An auxiliary panel board is located on the operating floor to centralize the distribution meters pertaining to this

(Continued on page 159)



PROCEDURE FO

PERSONAL health, process quality, and plant fire protection in industry all depend on an adequate supply of clean water. Therefore, proper maintenance of water storage tanks, which are widely used throughout industry, is an important part of the general water supply problem.

Tank types

Three types of water tanks are commonly used in industrial plants: (1) basement, (2) indoor roof, and (3) outdoor elevated. Maintenance procedures for all types are similar, although weather conditions have a greater effect on elevated tanks than on the other two types. Hence, individual tanks must be studied carefully before establishing a maintenance program. A schedule that overlooks one important valve, heater, or piping run has little value when it comes to prevention of failures.

To simplify maintenance, it is convenient to divide water systems into three sections: (1) supply pump, piping, and fittings; (2) storage section composed of tank, internal piping, and fittings; and (3) discharge piping and fittings. Such a division permits better understanding of the entire system, a more balanced maintenance program, and more rapid spotting of trouble before it becomes serious.

Supply Section

Basement tanks, Fig. 1A, are generally fed by gravity or pressure from the city main. In certain industrial plants, where the main is below the basement floor level, a pump may be used to supply the tank, but this arrangement is not too common. Gravity

CAUSES OF COMMON TROUBLES WITH WATER TANKS AND ACCESSORIES

Tank and Supports

Exterior:
Rusty; wood shrunken from lack of water; damage from falling objects or high winds; excessive sweating; holes in tank roof.

Interior:
Rusty; accumulated solids; peeling enamel.

Tower:
Corroded; bent members; loose turnbuckles; broken walkway planks.

Drip pan:
Clogged drain; accumulated trash.

Pumps and Controls

Pump:
Clogged suction or discharge; packing burned out; faulty "on-off" controls; oil leakage into casing; air bound; coupling out of alignment.

Motors:
Burned out or overheated; overloaded; worn, rotted or shorted wiring; improperly lubricated.

Air compressor:
Knocking; overheated; worn or broken belts; lubricant shortage or excess; dirty intake filter.

Air control devices:
Dusty, worn or pitted contacts; faulty wiring; broken resets; improperly calibrated diaphragms.

Piping System

Supply and discharge pipes:
Corroded; loose; broken; leaky joints or flanges frozen; corroded or broken clamps and hangers; strained swing joints.

Valves:
Clogged or noisy check valve; hardened stem packing; leaky flanges; rusted stem threads; unauthorized valve closures and openings.

Expansion joint and watertight pipe sleeves:
Leaky packing or caulking; loose bolts; bent or dented sliding tube.

Mercury gage:
Loss of mercury from pressure variation; broken gage glass; leaky water connections.

Heating System

Heater:
Fouled; leaky tubes and gaskets; clogged relief valve; rusted tubes, supply or return pipes.

Heater accessories:
Stuck, broken or leaky steam gage; poorly calibrated thermometer; defective steam or return control valves; clogged strainer; broken steam trap; strained swing joints.

FOR CORRECT WATER-TANK MAINTENANCE

Plant facilities that supply clean water to drinking fountains and processing equipment should be inspected and repaired at regular intervals. Best procedure is to use a scheduled maintenance program. It will prevent embarrassing failures

or pressure feed from the city main introduces few maintenance problems, corrosion and leaks being the only ones normally encountered. Pump supply increases the number of problems because both pump and piping must be maintained.

A pump in the supply section of indoor roof and outdoor elevated tanks, Figs. 1B and 1C, is generally necessary. City pressure in most localities is insufficent to raise water to the tank. With roof tanks, both indoor and elevated, supply pump is located in building basement. Outdoor elevated tanks supported by an independent tower generally have a valve pit or house located at tower base. The supply pump is located here if the pit or house is large enough.

Plant engineering experience shows that a weekly inspection of the supply section is sufficient to spot most major troubles. At this inspection, all valves, pipes and fittings should be checked for leakage, corrosion and sweating. Those valves, which are normally open, should be tried if they are not of the rising stem type. Outdoor piping might freeze in cold weather, and must receive careful attention during winter months. Replacement of damaged or deteriorated insulation immediately after it is found will prevent permanent injury to the piping and failure of plant water system.

Both water and driving ends of supply pumps should be thoroughly checked during weekly inspection. Packing, lubricants, motor, alignment, controls, pipe and wiring connections must all be checked carefully. In addition, cleaning of the motor, controls and pump is necessary to prevent future failures. When done during the weekly inspection, the cleaning chore is easier and insures a more thorough inspection job.

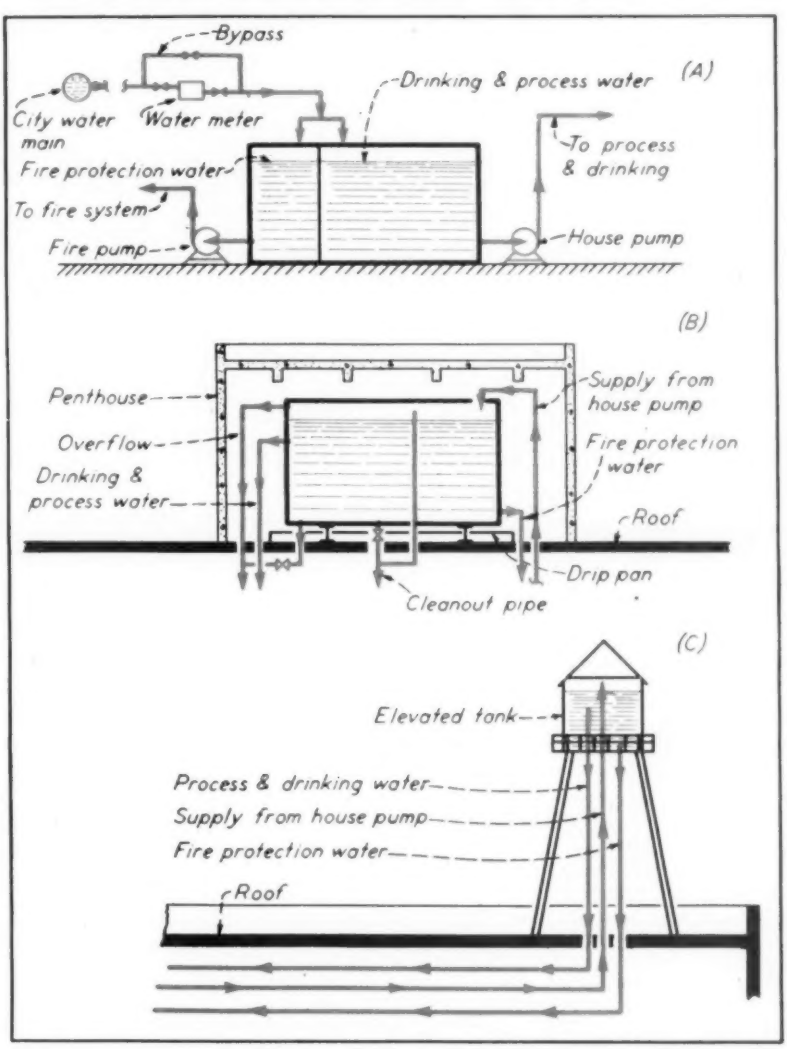
Annually, a complete inspection of the supply system is needed. This inspection is more extensive than the weekly one. Dismantling of the pump, motors and controls is advisable if weekly inspections have shown a gradual decrease in pumping efficiency, increased operating noise, or faulty controller operation. More than one man should be present at the annual inspection so that findings can be compared and corrective steps discussed. A carefully prepared record of the supply section condition, made during the annual inspection, will aid in future planning and selection of equipment.

To help spot troubles, refer to the table on the opposite page. All common ailments have been listed. Using these data, weekly and annual inspection procedures can be set up for any supply section after taking into consideration particular conditions which might introduce troubles other than those listed.

Storage Section

Steel plate, wooden and copper-lined wooden tanks are the types used most commonly in industrial plants. Steel tanks are more frequently se-

Fig. 1 — The three common types of water tanks: (A) basement, (B) indoor elevated, and (C) outdoor elevated. Basement tanks usually have two compartments; one for supplying water to fire-protection equipment, and the other for supplying drinking and process water



lected because they possess many advantages over other types. Basement tanks are of riveted or welded steel construction, and are often divided into two compartments, as shown in Fig. 1A; one tank is for fire protection water storage and the other for process water storage. Indoor roof tanks, Fig. 1B, are of similar construction but usually do not have separate compartments for fire and process water storage. Instead, the process water connection is made near tank top. As a result, only a certain gallonage can be drawn off for process and drinking purposes. The remaining water is kept in the tank at all times for fire protection service.

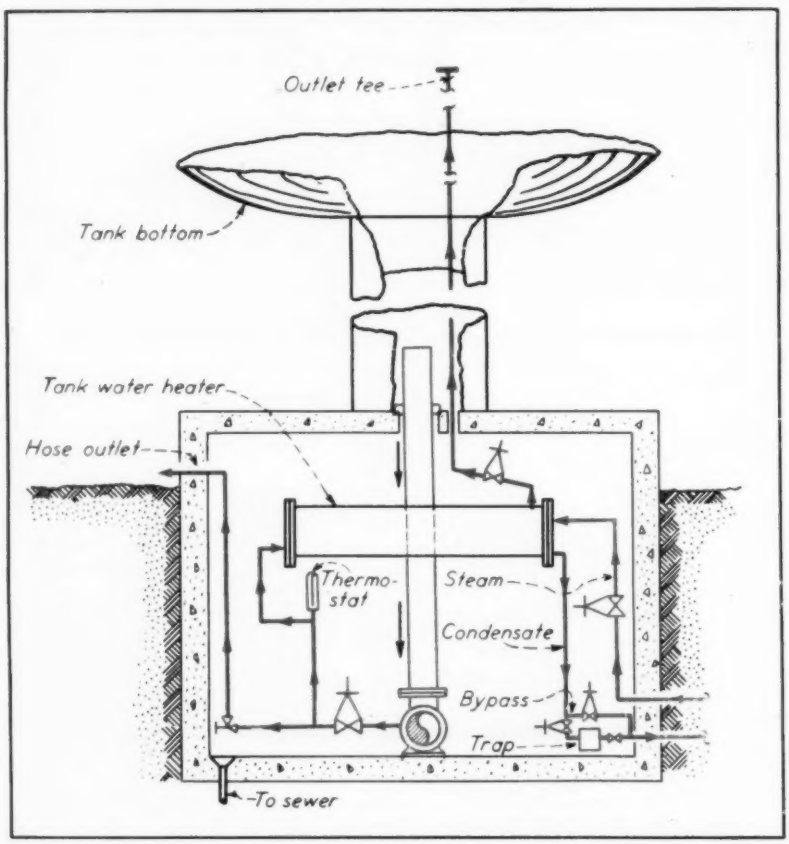
Outdoor elevated tanks, Fig. 1C, are located either on a tower secured to plant roof or on a tower mounted on concrete piers. Their construction is similar to indoor roof tanks except for tower structure and frost-proof casings for pipes. Elevated wooden tanks have frost-proof casings when located in regions with low winter temperatures.

Most common ills met in tank maintenance are corrosion, freezing, leaks, sweating and fitting breakage. Paint deterioration, water leaks, and accumulation of rain and snow are the most frequent causes of corrosion. Freezing is less common than corrosion, but the damage is usually far more extensive. Heavily loaded tanks have collapsed when the supporting structure became overloaded with ice. Every precaution possible must be taken to prevent freezing and corrosion because both actions weaken tank structures.

Weekly inspection of the tank is usually sufficient during mild weather. Tank inspection logically follows the supply system; by proceeding from the origin of plant water supply through to the points of use, exact condition of the entire system can be checked. Daily inspection of the tank and its heating system is required during freezing weather. During these periods, tank-water temperature should never fall below 42 F; otherwise, rapid freezing might occur. Where the heating system has sufficient capacity to maintain higher water temperature, minimum allowable value should be 50 or 55 F.

Besides the weekly inspection, a thorough annual check of tank, structure, heating system, and fittings is necessary. Drainage of the tank to permit interior inspection is good practice. Where a portion of tank water is used for fire protection, another source of supply must be connected to plant fire lines during tank drainage. All accumulated scale, corrosion products, and dirt must be carefully removed from the tank interior and heating coils during this inspection. If interior enamel coating of the tank has chipped off, swelled, or been damaged by cleaning tools, immediate replacement is necessary to prevent corrosion. Tests of heater traps, to see that they function, are advisable.

Fig. 2 — Typical piping connections for steam-heated circulation-type heater. Heater requires special maintenance to prevent winter freezing



Discharge Section

Tank type determines the general layout of discharge piping. Roof and elevated tanks supply process and drinking water by gravity. When the tank also supplies a fire-protection system, a pump may be used to give required pressure at hose nozzles. The tank maintains a pressure on the fire-pump suction line, eliminating need for priming devices. A pump is always used with basement tanks to raise the water to points of consumption.

Usual defects encountered in the discharge section resemble those in the supply section plus a few additional ones caused by differences in arrangement. Expansion joints in fire-service discharge pipes may develop leaks if not properly maintained. Discharge swing joints, check valves and control valves need close watching to see that unexpected failure does not cut off tank water. Mercury water level gage is a sensitive instrument requiring careful checking and repair.

Weekly and annual inspections of discharge section will prevent most major troubles. The Table on page 80 lists common defects.

Repair Precautions

If a tank contains water for fire-service, several precautions must be observed during repair periods. Plant insurance companies usually require notification of tank drainage, together with date of shutdown and completion of work. Rapid repairs are advisable to permit return of the tank to service. A large red tag, available from the insurance company, should be attached to tank supply valve to notify firemen that the tank is out of service.

A secondary water supply must then be connected to plant fire system. Pressure and capacity of this secondary system should be suitable for fire-protection service. If secondary supply is unavailable, plant fire pumps are to be operated continuously during the tank-drainage period. A man, assigned to fire-pump duty, must be ready at all times to operate the pumps at full capacity. Posting of extra watchmen and notification of local fire and police departments of tank shutdown will aid fire detection and prevent fire spread.

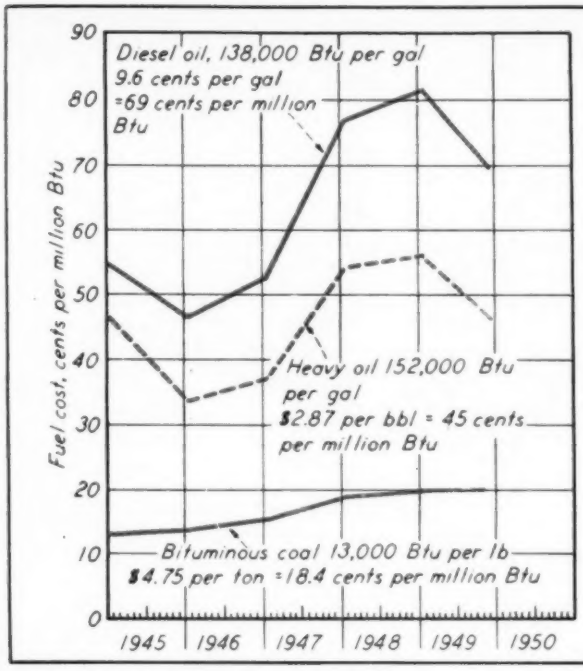


Fig. 1—Variation in fuel prices since 1945

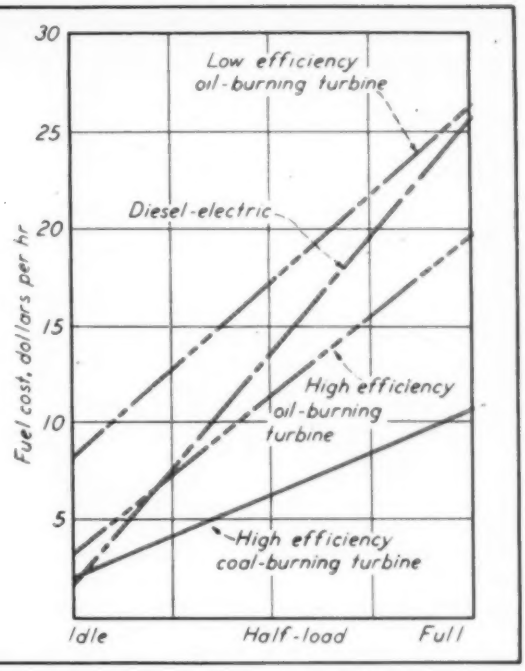


Fig. 2—Fuel cost per hour for 4500-hp locomotives

COAL-FIRED GAS TURBINE LEAVES EXPERIMENTAL STAGE

With the problem of blade erosion from flyash practically solved, the coal-fired gas turbine* now appears ready to compete economically with any prime mover in the power field

J. I. YELLOTT, *Director of Research, Locomotive Development Committee*

THE LOCOMOTIVE Development Committee of Bituminous Coal Research, Inc. has, for the past five years, been concentrating upon the job of making the open-cycle gas turbine burn pulverized coal. Most pressing need for a coal-burning gas turbine power plant today is in the locomotive field, where bituminous coal continues to be the cheapest fuel. Since 1945, railway fuel prices in the east have varied as shown in Fig. 1, which presents the average costs reported to the I.C.C. by three major roads.

The gas turbine, because of its ability to use low-cost fuels with good efficiency, is a formidable competitor of

*Abstract of a paper delivered at the Midwest Power Conference, Chicago, April, 1950

• Roy B. White, president of the Baltimore & Ohio Railroad, is chairman of the Locomotive Development Committee. This committee is composed of the chief executive officers of the Baltimore & Ohio Railroad, Chesapeake & Ohio Railway, Illinois Central System, Louisville & Nashville Railroad, New York Central System, Norfolk & Western Railway, the Pennsylvania Railroad, Virginian Railway, New York, Chicago & St. Louis Railroad, the M. A. Hanna Co., Island Creek Coal Co., Pocahontas Fuel Co., Inc., Pittsburgh Consolidated Coal Co., Inc., and Sinclair Coal Co. The experimental coal-burning gas-turbine plant incorporates ideas contributed by the many organizations cooperating in the program of the Locomotive Development Committee. Fred D. Buckley is the manager of the Dunkirk installation, and the smooth operation of the plant is due in large measure to the care with which the installation was planned by him and Charles F. Kottcamp, formerly assistant to the director of research of the committee, and now chief fuels and lubrication engineer with the Gulf Oil Corp. The assistance of Allis-Chalmers is also gratefully acknowledged.

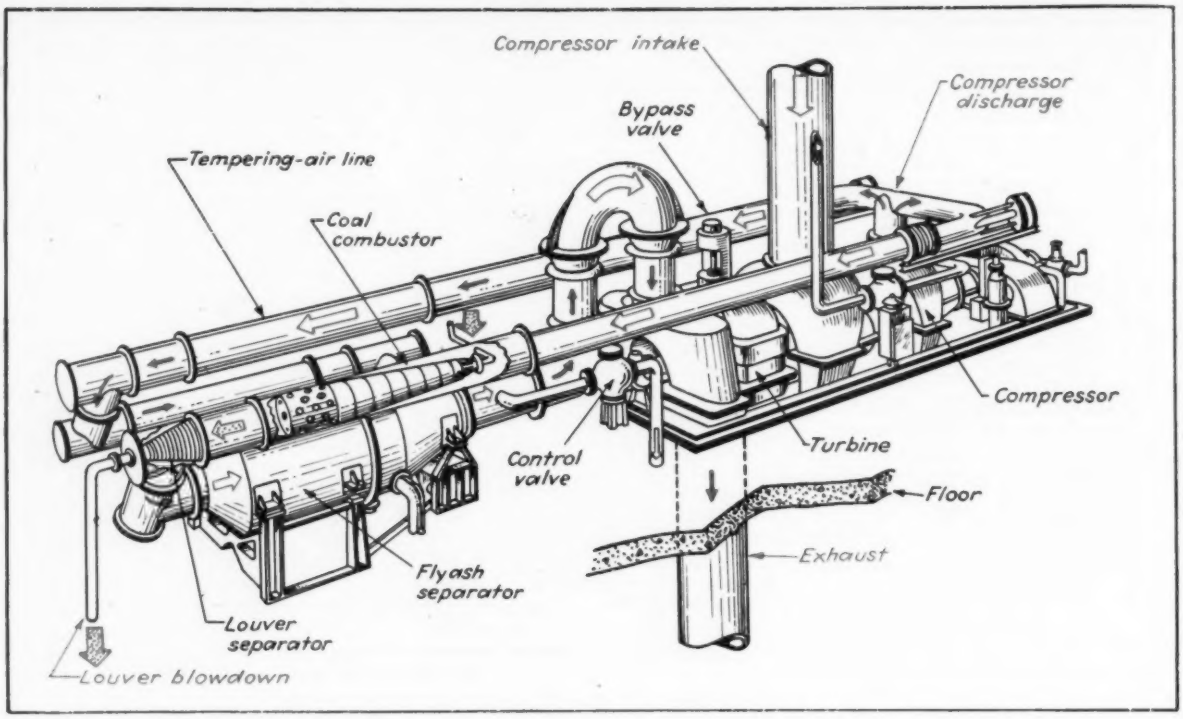


Fig. 3—The U. S. Bureau of Mines provided a Houdry process gas turbine, which is arranged for compressor discharge into either the coal combustion system or the oil-burning startup section

the diesel-electric locomotive for road service.

Fig. 2 shows reasonable estimates of the hourly fuel costs, from idling to full load, of four road locomotives, using eastern prices. The vastly greater world-wide coal reserves, as compared with oil, give long-range significance to the program.

Preliminary Tests

The coal-burning gas turbine plant, which is the subject of this progress report, is the result of four years work during which all the necessary components were first tested on a small scale at atmospheric pressure. Simultaneous attacks were made upon the problems of coal handling, combustion, and ash removal.

At Johns Hopkins University, equipment was set up to prepare, pressurize, and pulverize coal, and to burn it in a non-slagging combustor at rates of a few hundred pounds per hour. Work continued until mid-1948 to obtain fundamental information on coal handling under pressure, and coal feeding.

At Battelle Institute, small-scale combustion installations were made for both atmospheric and elevated pressures. A vortex combustion chamber, patterned after British design, was used with some success both at Battelle and at Hopkins, but this was soon replaced by the simpler and more compact film-cooled cylindrical combustor. Pressurized combustion of coal was undertaken for the first time when a small refractory lined tube was tested at Battelle, using shop compressors to supply air for combustion. Batch operation was used with pulverized coal supplied from a pressurized tank (1).

War surplus turbo-superchargers were used at Battelle with air-cooled jet-engine type combustors to operate on a "bootstrap" cycle. This equipment was successfully operated for many months, the first tests being made in November, 1946.

Studies of the flyash problem were undertaken in 1945 at the Institute of Gas Technology in Chicago, where extensive tests were run to determine the relation between the dust content of high-velocity air jets at high temperatures (800 to 1300F), and erosion of turbine-blade materials. This work (2) led to the conclusion that blade cleaning, rather than replacement, would probably be needed if conventional separators were used to remove the flyash.

Other projects initiated at the Institute of Gas Technology covered the use of various attrition devices to improve the performance of the coal atomizer. Attempts were made with some success to pressurize finely crushed coal by the use of long slow-speed screws. Partial gasification of coal was also studied, using the coal atomizer with the addition of highly preheated air in a new vortex chamber.

Purdue University investigated the influence of sulphur dioxide upon stainless steel. It was found that, in the presence of the excess oxygen which characterizes gas-turbine combustion, the small concentration of SO_2 resulting from the sulphur in coal had no measurable effect up to 1800 F.

Southern Research Institute developed an air-balance device for determining feed rates from a pressurized coal tank. Various modifications of this arrangement, using commercially available equipment, were used in subsequent large-scale tests.

Pilot Plant Installed

By mid-1946, a pilot plant had been installed at the Dunkirk, New York, plant of the Alco Products Division, American Locomotive Company, where coal could be burned under pressures as high as 60 psig at rates up to 1000 lb per hr (3). A larger version of the Johns Hopkins coal system was constructed, using a Standard Stoker piston coal pump to pressurize the coal. Feeding of crushed coal from the pressurized storage tank was accomplished by a variable-speed screw.

A coal atomizer was used for pulverization. Shop air at rates up to 1000 lb per minute was available to burn the coal, cool the combustor, and chill the ash. A battery of small centrifugal separators removed most of the fly-

ash before the heated air was released through a pressure-reducing valve, and allowed to pass through a turbo-supercharger to determine the effect of the remaining ash upon high-speed turbine blades.

Operation of the pilot plant disclosed a number of major problems, which had not been discovered in small-scale operation at atmospheric pressure. Most serious was the fact that, with 90% combustion efficiency, the best then obtainable with cold-walled combustors, the carbon remaining in the ash burned vigorously in the flyash separators. This disturbing situation caused attention to be turned to a ceramic-walled, slagging combustor, in which efficiency of combustion consistently approached 98%, and about half of the ash appeared as slag in lumps of moderate size. The remaining flyash was sufficiently low in carbon content to be harmless to the flyash separators.

The Dunkirk pilot plant is now being dismantled, since the Houdry turbine, described in this paper, has provided greatly superior facilities for full-scale testing. Work is continuing, however, on an atmospheric-pressure, full-scale, horizontal ceramic combustor. For low-ash-fusion and low-volatile coals, the ceramic tube shows considerable promise; such excellent results have been obtained, however, with the all-metal combustor under actual turbine conditions that this type will be used in the first tests of the actual locomotive power plant.

Small-scale, low-pressure tests showed the necessity of working with full-scale equipment under actual gas-turbine conditions. After a survey of available facilities, this phase of the work was undertaken in conjunction with The Turbodyne Corporation, a subsidiary of Northrop Aircraft, at the Kaiser Steel Mill, Fontana, California. At Fontana, a spare blast-furnace blower, driven by a steam turbine, gave a firm supply of 100,000 cfm of free air, at pressures up to 25 psig.

First Full-Scale Tests

During the summer of 1947, coal-handling equipment of locomotive size was installed at Fontana. Coal from a locomotive stoker was fed through a hammer mill and slide-valve lock hopper into a large, high-pressure tank. A variable-speed screw feeder was used in the initial combustion tests but, after encountering many difficulties in attempting to control the feed rate from a tank in which the pressure varied, a belt feeder was later substituted. The system was first operated under pressure in December, 1947, and in the months which followed, it became evident that film-cooled metal combustors could be used with acceptable range, efficiency, and life.

Feeding from a pressurized tank appeared to be impractical on a large scale, and consequently an attack was made on the problem of continuously pressurizing finely crushed coal. A rotary pump was developed, in which extremely close clearances were maintained by the use of a refined mechanical design. It was found that such a pump was a practical means of transferring coal from an atmospheric-pressure source into a line at pressures up to 140 psi.

Flyash Removal

After good progress had been made in the field of coal preparation and combustion, attention was turned to the problem of ash removal. Because of the extremely wide size range of the ash particles, it was found necessary to use a two-stage system. A louver separator was used as the first stage, to concentrate the large particles of ash into a small quantity of flowing air, which was then blown down to atmospheric pressure through an aspirating nozzle. The quenching of the incandescent ash particles by the aspirated cold air prevented burning the separator on this blowdown line.

As a second stage of flyash removal, a battery of small cylindrical separator tubes of the straight-through type was employed. These tubes caused most of the dust to be removed from the air by imparting a vigorous spin to the air and dust, and drawing off the concentrated solid particles in a small secondary stream of air. Again, the continuous blowdown method was used to dispose of this dust.

Extensive tests of the ash-removal system indicated that very few particles larger than 20 microns in diameter were getting through the system, and most of these appeared to be agglomerates, rather than individual particles. By early spring of 1949, it was concluded that the combustion and ash-removal systems were developed to a point where it would be safe to operate an experimental turbine of large size on coal as its primary fuel.

The United States Bureau of Mines, Department of Interior, made available to the Committee a Houdry process gas-turbine plant, originally des-

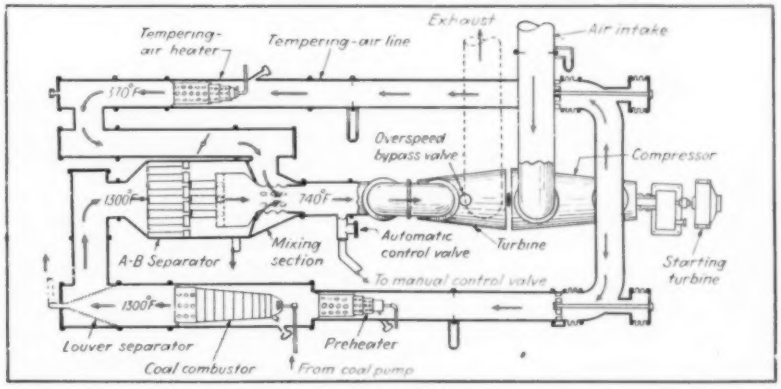


Fig. 4—Coal-burning and ash-removal equipment is made of stainless steel so it can operate at 1300 F. Turbine runs at 740 F

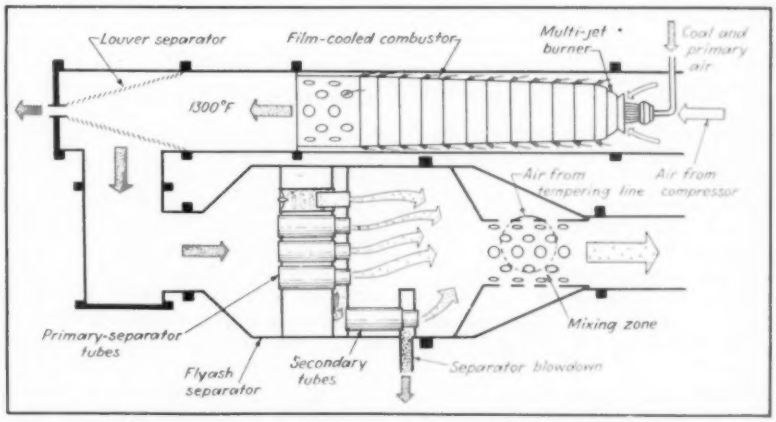


Fig. 5—Final removal of flyash is accomplished by passing about 90% of the 20,000 cfm of combustor gas through this separator

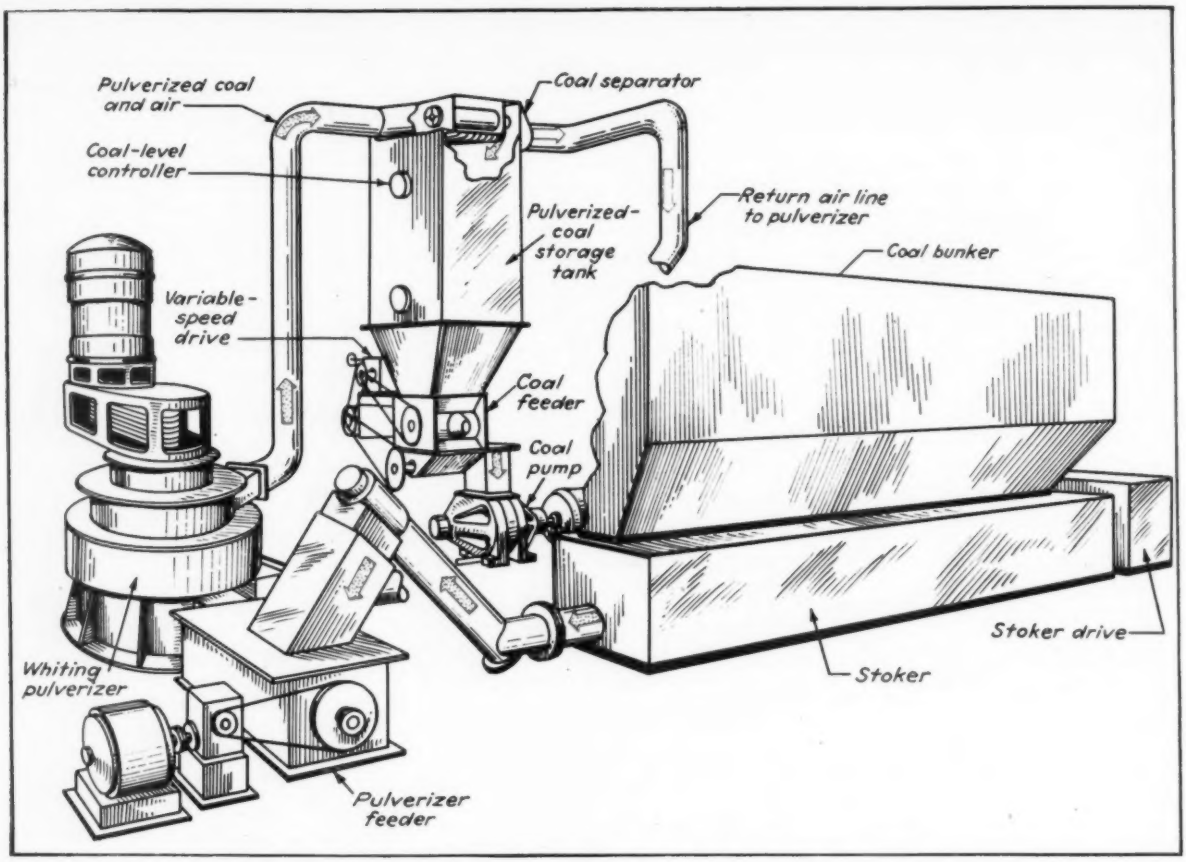


Fig. 6—Fuel-handling system incorporates the preparation and feeding of the coal at atmospheric pressure. This is the only pressure remaining constant in a gas turbine under varying loads

tined for a Russian oil refinery. After careful consideration of the many possible arrangements, the system shown in Fig. 3 was adopted. The compressor of the Houdry unit takes air from the atmosphere through a metering section and silencer.

Compressor discharge is divided into two lines, one of which contains the coal combustion system and the fly-ash separators. The other line contains an oil-burning system, so the unit may be started on oil, and then transferred to coal.

In order to simulate the performance of one of the twin combustors, which will be used with the 4200-hp locomotive turbine, air flow from the compressor can be divided so that about 93,000 lb per hr will pass through the coal side, while the remaining 113,000 lb pass through the oil side. An oil-fired air preheater on the coal side, provides the temperature rise, which will be encountered in the regenerator of the locomotive gas turbine.

Coal-burning and ash-removal equipment is made entirely of stainless steel, so it can be operated safely at 1300 F. Since the Houdry turbine is limited to a maximum temperature of 1000 F, air, which comes through the oil side of the system, is introduced at the outlet of the flyash separation apparatus, thus reducing the 1300-F coal-combustor outlet temperature to suit the turbine, Fig. 4.

The oil-burning combustors are quite similar to the film-cooled combustors used in jet aircraft. Peabody wide-range burners are used to give good atomization at low combustion rates. Spark igniters, equipped with fixed-orifice oil burners, are used in all the combustors.

Coal-Burning Combustor

The coal-burning combustor, which is currently in use at Dunkirk, is designated as Fontana No. 5, since it was the fifth of a series developed and tested at Fontana. It consists of telescoping cylindrical sections of stainless steel, $\frac{1}{8}$ inch thick, supported by external girders. A riveted construction was originally employed, but this was replaced because ash deposits built up in the wake of each rivet. The cooling of the combustor is accomplished by admission of air at the slots existing between each of the rings. The mixing of the excess air with the products of combustion takes place through a number of large holes in the last 30 in. of the combustor.

Admission of coal to film-cooled combustors has received much study, and the burner which is currently in use is a Dunkirk modification of a multi-jet device originally used at Battelle Institute. The combustion efficiency, obtained with this arrangement, has consistently exceeded 95%. Coal was burned in this combustor at rates up to 1800 lb per hr. After a continuous test of 32 hours, the combustor was found to be relatively clean and completely undistorted.

Development is now going forward to improve the range of this type of combustor, so the gas turbine can be operated on coal without the need of an oil pilot flame. The coal flame is invariably started by first lighting off the oil-fired igniter, and then turning on the coal supply.

The louver separator, forming the first stage of the ash-removal equipment, was also built by Turbodyne and originally tested at Fontana. This louver was designed from data made available by the American Air Filter Company of Louisville, and it has

withstood several hundred hours of operation without any visible deterioration. It removes approximately 50% of the solids, and eliminates stratification in the heated air leaving the combustor.

Final Flyash Removal

Final removal of the flyash is accomplished by a battery of 18 American Blower Type ST separators, Fig 5. Approximately 90% of the 20,000 cfm, which come from the combustor, pass directly through the tubes, transferring most of the remaining dust into approximately 10% of the air stream passing through the secondary tubes.

This dust is concentrated again into approximately 1% of the original air stream, which is then blown down through a small nozzle. The remaining 9% containing the fine dust, not removed in the secondary collection system, can then be readmitted to the main stream as it passes toward the turbine.

Mixing the relatively cool air from the oil-heater side with the 1300 F from the coal-burning equipment is accomplished by a mixing zone, which is virtually the same as the cooling section at the end of the combustor. This device, designed by the Battelle Combustion Group, has functioned satisfactorily, and it is possible to maintain whatever temperature the turbine requires for self-sustaining operation, while the coal-burning equipment is being run with a 1300-F outlet temperature.

General arrangements of the combustor used up to the present time are shown in Fig. 5. At a firing rate of 1800 lb of coal per hr, heat release is 750,000 Btu per hr per cu ft, or 6,000,000 Btu per hr per sq ft of cross section. Under these conditions, the combustor runs relatively cool and clean.

There has been very little slagging in the combustor, and virtually all of the ash appears as a fine dry powder suspended in the combustion products. Building up of ash on the combustor wall takes place only where the air flow is interrupted by some protrusion, such as a rivet. Deposition appears to be an aerodynamic phenomenon, which is minimized by the use of very finely pulverized coal.

The coal for the Houdry gas-turbine plant is provided by the system in Fig. 6. An Iron Fireman stoker supplies coal in minus 2-inch lumps to a Whiting high-speed impact mill, which includes a fan and classifier. The fine coal, 97%-100 mesh, flows with the conveying air upward through an 8-in. pipe into a coal separator located in the top of the pulverized coal-storage tank. This separator is a combination of two American Blower Type ST 361 tubes, and a louver.

Cleaned air is returned to the pulverizer. The vented air, always required in a closed-circuit system such as this, is the secondary flow from the American Blower tubes. Makeup air is provided through an opening at the inlet of the pulverizer. The level of coal in the tank is controlled by a single Fuller rotary level indicator located just below the coal separator. This controller starts and stops the motor on the pulverizer feeder. The stoker operates in response to a level control on a small hopper from which the pulverizer feeder takes its supply.

Feeding of coal is accomplished by a variable-speed drum feeder. It was found after the first tests of this setup that pulverized coal in the storage tank was highly aerated, and its bulk density was as low as 20 lb per cu ft. Likewise, this coal is fluidized to such an extent it will flow very readily through even the smallest crevices. Some difficulty has been encountered from leaks in the feeder, and this problem is still undergoing study.

The fundamental philosophy of the system in Fig. 6 incorporates the preparation and feeding of the coal at atmospheric pressure, the one pressure remaining constant in a gas-turbine system under varying loads. The continuous pressurizing of the coal, at whatever rate may be established by the feeder, is accomplished by a rotary coal pump.

Features of Coal Pump

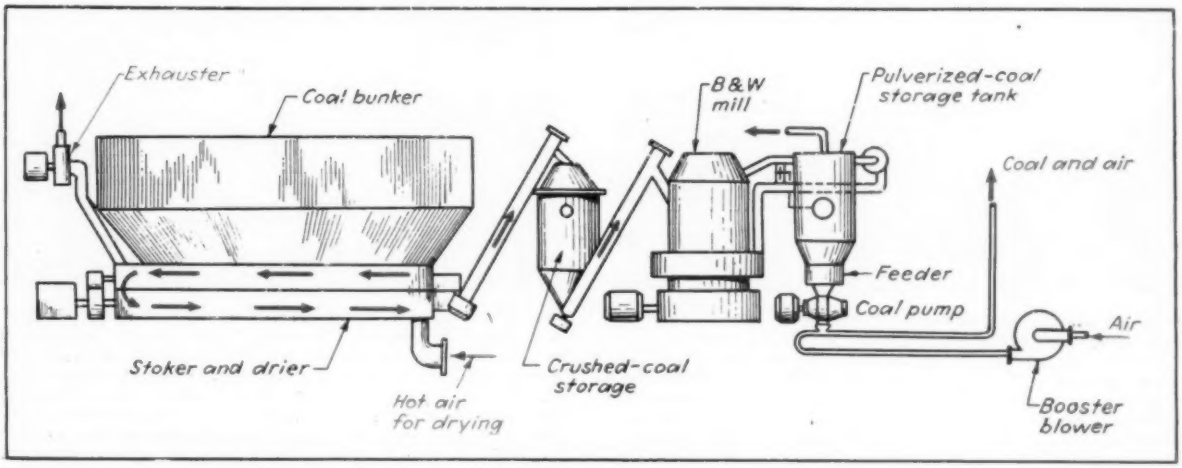
Two different types of pumps have been tried extensively, but it appears that the blow-through feature pump, developed by The Turbodyne Corporation at Fontana, is essential. The pulverized coal is carried from the bottom of the pump to the combustor by compressed air flowing in a 1¼-in. line. The throttle for the plant is, therefore, the variable-speed drive on the coal feeder. Pulsations, which might be expected to result from operation of the drum feeder and coal pump, have proved to be of no importance.

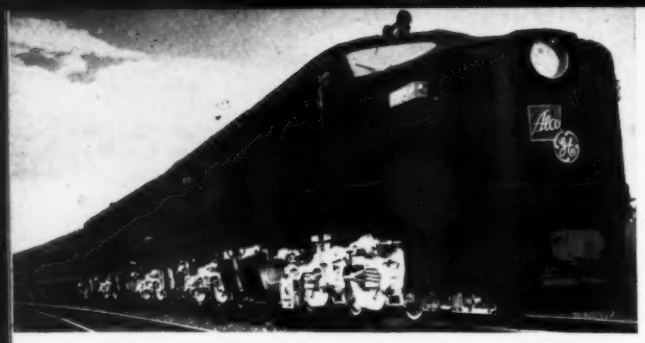
The Dunkirk installation is not intended to produce power, and accordingly, it has no generators. It is started by a small steam turbine, rigidly coupled to the high-speed shaft of the reduction gear. In a future application of this power plant, it is expected that a 60-cycle alternator will be coupled to the low-speed shaft.

Control of the plant is effected by varying the amount of high-pressure air which is bled out, and the amount of fuel supplied. The unit is normally started by bringing it up to about 2000

(Continued on page 158)

Fig. 7—Arrangement of coal preparation plant as designed for the first experimental locomotive. It will supply a 4200-hp gas turbine just completing its preliminary oil-fired tests





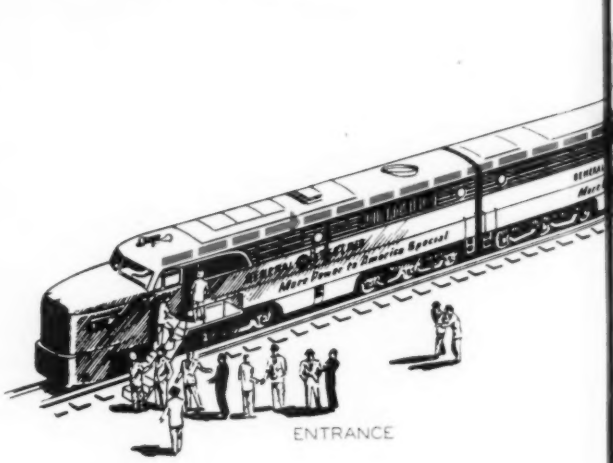
MORE POWER TO AMERICA

- **Exhibiting products for the generation,**
- **Grouped in 10 cars hauled by 4,500-hp**
- **Will visit 150 key industrial centers in**
- **Modern locomotive is a major exhibit**

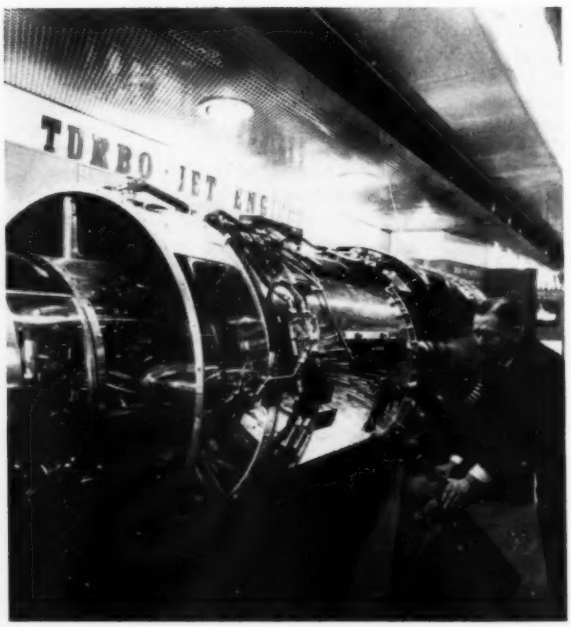
MORE THAN TWO YEARS in the planning and a year in the making, this train is a project of the General Electric Company's Apparatus Department. The locomotive and cars, incorporating the latest innovations in streamlined motive power and passenger car design, are filled with more than 2,000 exhibits of the most modern electric products, systems and equipment.

The streamliner is not only unique in industrial marketing history, but is also an important phase in the G-E "More Power to America" program. Launched immediately after the war, this program is designed to inform industry of the opportunities for improvement through increased electrification. In adding its share to this policy, the train will visit approximately 150 key industrial centers during 1950 and 1951. At each stop, it will be inspected by invited representatives of electric utilities, the manufacturing and transportation industries, the armed services, the federal government, and municipalities.

Arrangement of exhibits, including scale models and prototypes, is in itself interesting. Visitors first see equipment for producing power, then apparatus for transmitting and distributing it, and finally the techniques and products for utilizing it profitably.



C. A. Falkenau, tour manager of the ten-car train, is shown operating one of the exhibits in the Civic Improvement section. By pushing a button mounted on the panel, he turns on one of the street lighting luminaires. The Civic Improvement section contains displays of equipment for electric transit, recreational lighting, smoke density indication, traffic control, airport and street lighting, sewage treatment, and fluorescent lighting for highways



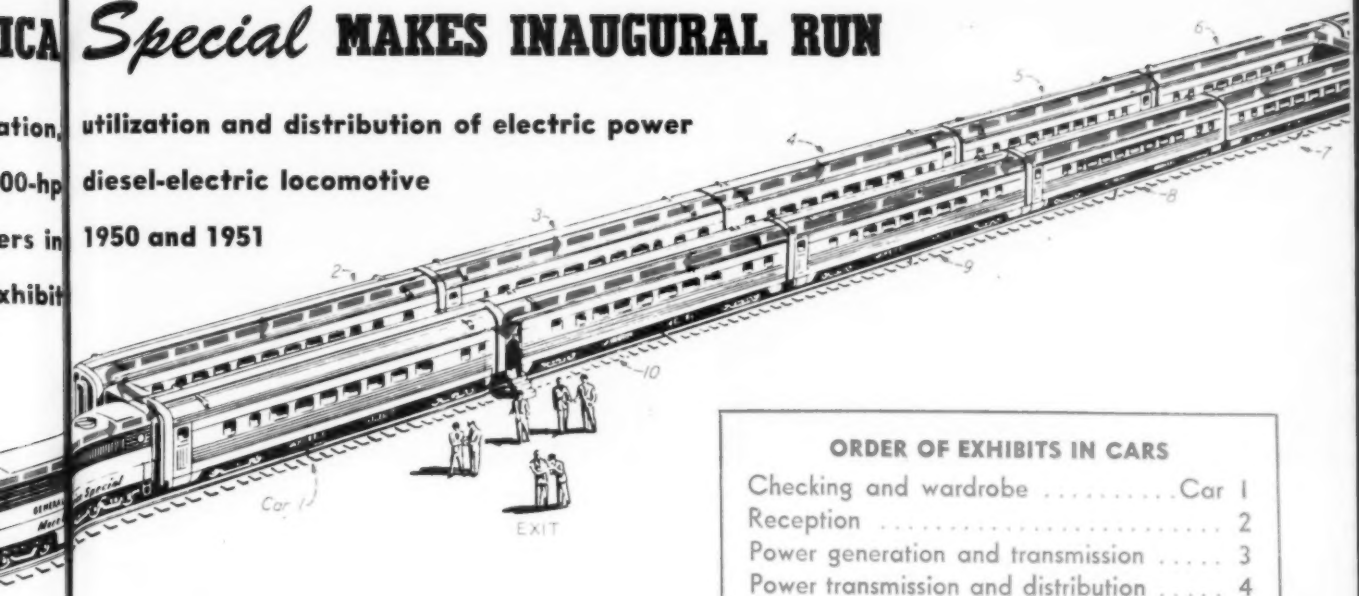
H. P. Bish, manager of General Electric's Aircraft, Federal and Marine Divisions, Apparatus Department, inspects a full-size cutaway model of the J-47 turbojet engine. Designed and built by G.E., it powers the North American F-86, as well as several other military aircraft. In 1948, the F-86 set the world's speed record of more than 670 mph. The cutaway engine is one of several displays in the National Security section of the More Power to America Special

Special MAKES INAUGURAL RUN

utilization and distribution of electric power

diesel-electric locomotive

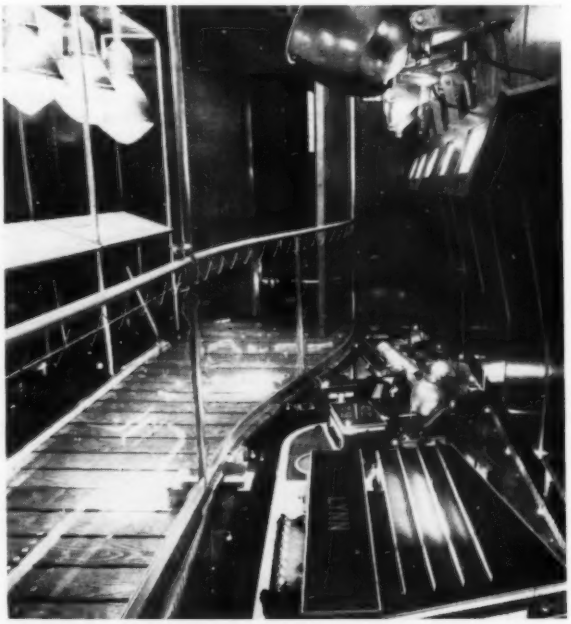
1950 and 1951



Almost a quarter-mile long, the train is comprised of ten new stainless-steel cars hauled by an Alco-GE two unit 4,500-hp diesel-electric locomotive. Electric power for train heating, lighting, air-conditioning, as well as for the scores of operating exhibits on board, is furnished by diesel-drive undercar power plants. This train represents the first attempt to display, in one series of related exhibits, the complete range of products for production, distribution, utilization of electric power

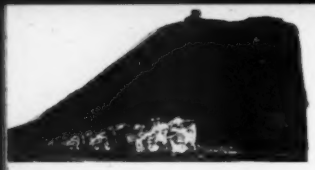
ORDER OF EXHIBITS IN CARS

Checking and wardrobe	Car 1
Reception	2
Power generation and transmission	3
Power transmission and distribution	4
Drives	5
Drives and materials handling	6
Welding, industrial heating, service shops, and renewal parts	7
Lighting components	8
Measurements and civic improvement	9
National security	10

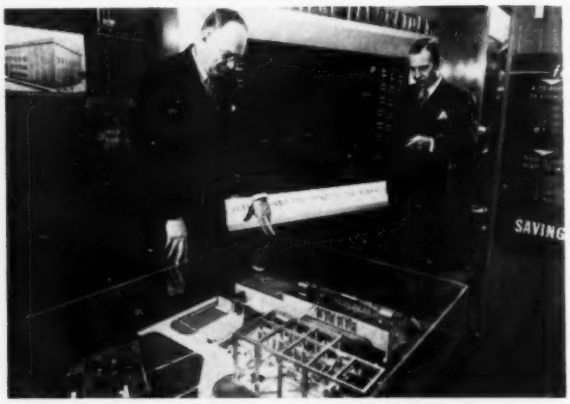


How planned industrial lighting "pays off" in terms of increased production, protection, safety, efficiency, and company prestige is explained by the exhibits in Car 8. Illustrated here is a realistic scale model of a properly lighted factory area. Also demonstrated in the exhibit are eleven major outdoor lighting applications within a factory area; each light has been correctly "spotted," has a definite purpose, and has been chosen for a specific job

Visitors can operate many of the exhibits in the Drives and Controls section of the train. K. H. Runkle, manager of G-E Industrial Divisions, is shown examining a drive that continuously moves a 21-ft steel strip, 6 in. wide, over a series of rollers. Tension, direction of rotation, and speed of the reversible strip can be controlled by the visitor. Speed of this drive ranges from 60 to 1,500 fpm. Thickness of the strip is shown by the new beta-ray gage



Car 9 includes hundreds of precise industrial instruments, including specials for laboratories and research centers. This visitor is looking over a display of watthour meters



J. W. Belanger and J. J. Huether, General Electric officials, inspect a scale model of the high-power test laboratory being built in Philadelphia by G-E's Switchgear Divisions

Model of 230-kv breaker in Car 3 uses colored lights to show interruption of 10 million kva in 0.05 sec. Operating it are G-E Apparatus Department officials H. V. Erben, vice president, and J. S. Smith, manager sales promotion

Power generation exhibits in Car 3 include this mock-up model of a hydro-generator in which the thrust bearing is highlighted. Proper application and efficiencies of all types of turbines are demonstrated throughout this exhibit

One of the major power-generation exhibits is this turbine in bas relief and actual turbine components. Visitors press buttons near the components, which light up sections on the transparent bas relief where the parts are located

Drives for all types of industrial machinery and equipment are exhibited in cars 5 and 6. Here, C. H. Lang, G-E vice president, and C. P. Fisher, Jr., manager of Exhibit Train Division, "spot" a load in the materials-handling section

CORRECT POWER PLANT CYCLE APPLICATIONS ARE ESSENTIAL

WITHIN a given industry there tends to be a resemblance in types of cycles used. This results from a similarity of products, manufacturing methods, and quality requirements. Although there will be found outstanding exceptions in every industry, plants are usually designed and constructed to take advantage of certain local conditions or unusual manufacturing requirements. Regardless of the industry considered, a study of plants or units installed over a period of years will show a gradual increase in steam and electrical generating capacity together with an increase in steam pressures and temperatures.

Energy Demands

Increased production throughout industry has, in general, brought an increased demand for electrical energy without a corresponding increase in steam demands. In other words, process steam loads have remained nearly constant while electrical demands have risen. This condition results from wider use of electrical driven manufacturing machinery and electrical controls. Electric motors have replaced steam engines for driving such units as air compressors, pumps and fans. To meet the increased need for electrical power, industrial plant designers revised cycle layouts to obtain maximum efficiency under the new conditions.

Central Station

Central station practice showed conclusively that high-pressure high-temperature steam turbines permitted more economical production of electricity than low-pressure low-temperature units. Hence, as electrical loads increased, industrial steam pressures and temperatures also rose. Today, many new industrial installations are in the

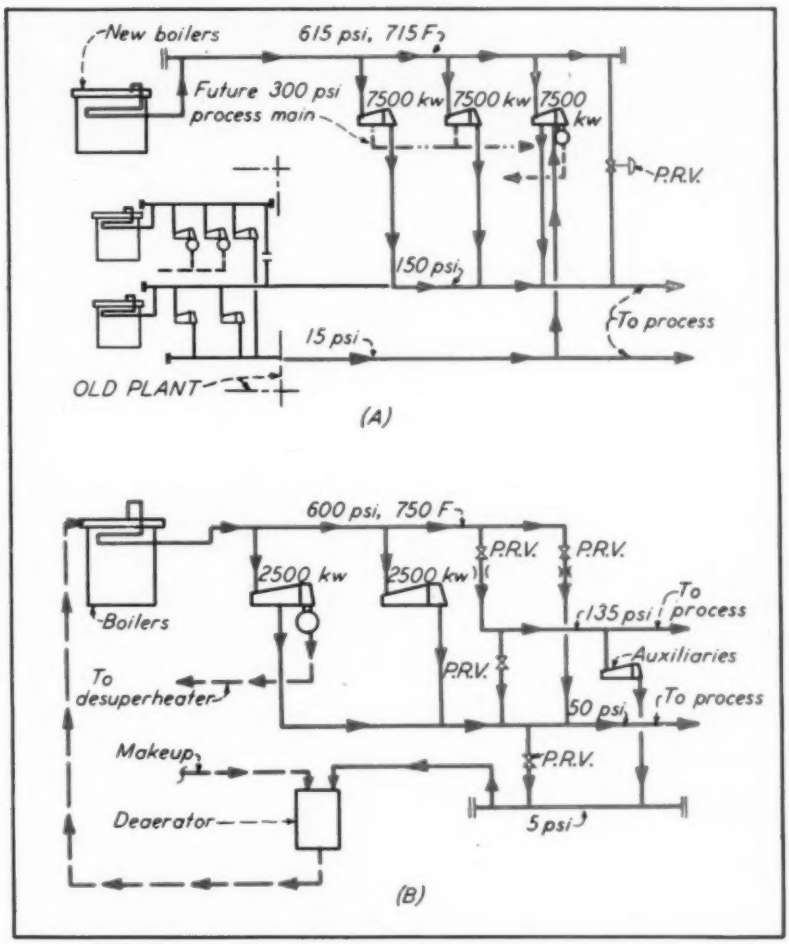


Fig. 1 — Rearrangement and topping an old installation (A) increased the output and efficiency of this refinery's steam power plant. The flow diagram of chemical manufacturing power plant (B) illustrates the balancing of a typical steam generating system with two turbines

Properly selected power plant cycle can increase capacity and efficiency of steam equipment in chemical, steel, rubber, textile and other industrial fields. Herein are presented typical installations and flow diagrams for specific applications. They can be modified for use in a wide variety of manufacturing plants*

*In this article, which is the third and concluding part of a series, the principles and practices advocated in the two preceding parts are applied. For these parts, see INDUSTRY AND POWER, April, 1950, page 84, and May, 1950, page 82.

Articles of a similar nature, incorporating detailed flow diagrams and charts, will be published in forthcoming issues. In July, look for data on plant heating with high-pressure high-temperature water.

400 to 900 psi pressure range with temperatures up to 850 F. Certain large industrials operate at 1,300 to 1,400 psi. One, at least, uses 2,500 psi. Such plants approach the central station in design, unit size, and operating force required. Therefore, they cannot be considered typical industrial stations.

Along with the increased pressures will be found larger generators, turbines, and more extensive application of condensing extraction units. Such changes in main units bring other alterations throughout the industrial plant—more extensive piping, control, pumping, and auxiliary systems. When it is considered that many industrial plants generate as much electrical energy as some moderate size central stations and, in addition, supply up to one million or more pounds of steam per hour to process, the importance of cycle arrangement can readily be understood.

Industries Served

Hardly an industry can be mentioned that does not have a few privately owned power plants. The chemical industry, including petroleum producers, is second only to central stations as far as steam producing capacity is concerned. Steel follows the chemical industry with paper, food, rubber, textiles, metal-working, glass, automotive, and shipbuilding industries taking up other positions in the list. In rating industries in terms of number of steam generating units purchased, the paper and pulp industry is next in order after central stations.

Chemical Industry

Fig. 1A illustrates a typical modern industrial plant cycle; it shows how an old refinery, built in 1923, was "topped" to provide greater electrical and steam capacity. The original plant consisted of ten 215-psi boilers, three 3,000-kw turbines, and sixteen 150-psi boilers together with a number of smaller mechanical drive turbines for boiler feed and refinery service. When process steam and electrical demands began to exceed plant capacity, studies indicated that a 600-psi plant operating with 150-psi backpressure would provide the best facilities for the increasing process load.

Three 300,000 lb per hr boilers operating at 615 psi and 715 F supply steam to three 7,500-kw turbines superposed on refinery drives. Two of these turbines exhaust at 150 psi, and the third, a mixed-pressure condensing type, has a 150-psi extraction connection. In addition, excess steam from the 15-psi process header can flow to the mixed-pressure turbine. High-

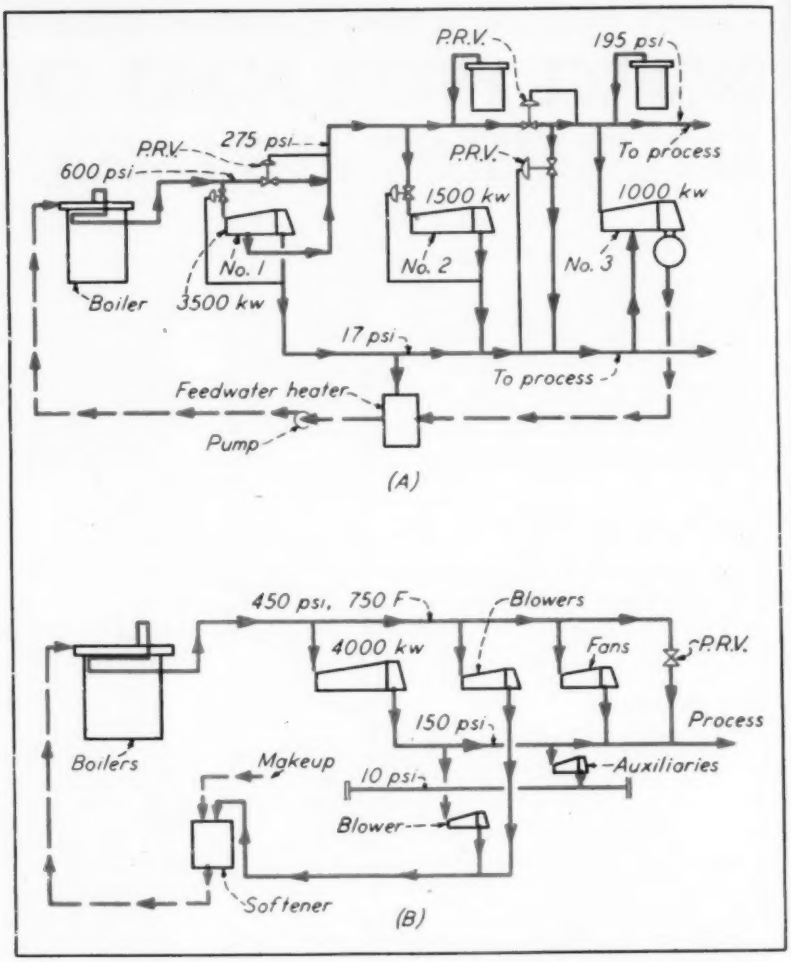


Fig. 2 — Typical paper mill turbine arrangement (A) affords a more efficient power plant with little or no waste steam. Lower diagram (B) shows how a moderate size steel mill utilized waste products to generate steam in its power plant. It was adopted to cut overhead costs

pressure steam not required by the three turbines flows through a pressure reducing valve and desuperheater to the 150-psi process header.

On completion, this plant provided one of the best power-process balances obtainable in the refining industry. No steam is wasted to the atmosphere, turbines are high-efficiency units, and several fuels can be burned. Refinery gas is the main fuel but natural gas, oil, and a refinery natural-gas mixture can also be utilized. Arrangement for future burning of pulverized petroleum coke is provided. For best efficiency, the refinery base load is carried by the new boilers and demand fluctuations are cared for by the old 150-psi boilers. Initial structural costs were reduced by outdoor installation of the new boilers with a one-story structure to house controls, firing aisle, and fuel and feed pumps.

Extensive motorization of refinery drives would have been necessary if three superposed backpressure turbines had been installed instead of two in combination with a mixed-pressure condensing unit. This resulted from design logic; for example, it would have been poor design to install three superposed turbines and waste excess low-pressure process steam. Also, if refinery drives were changed from turbines to motors to absorb the additional power produced by excess low-pressure process steam, initial costs would be high. Therefore, the mixed-pressure condensing unit in combination with superposed units provided greatest flexibility and efficiency.

Pharmaceutical Industry

One modern industrial plant, that serves a chemical and pharmaceutical manufacturer, has a cycle consisting of two 2,500 kw turbines, as shown in Fig. 1B. It comprises one condensing

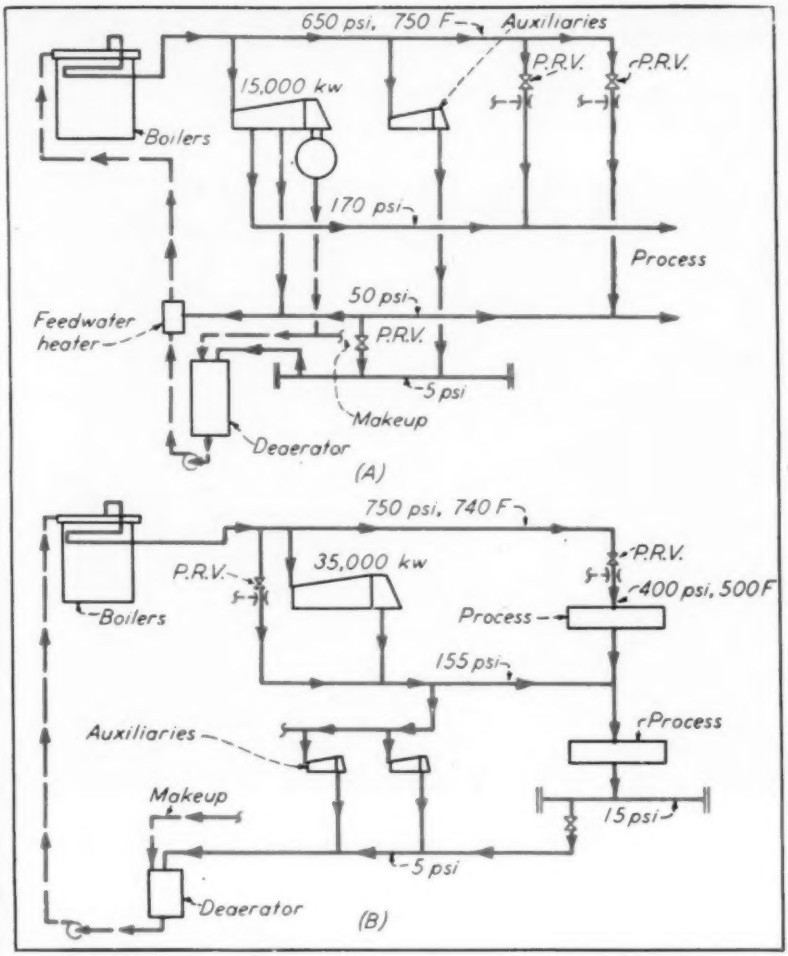


Fig. 3 — Cotton mill power plant (A) generates large quantities of electrical power to drive machinery. Extracted steam is utilized in bleaching and other textile operations. Synthetic rubber is produced in the plant utilizing the flow diagram illustrated in drawing (B)

extraction unit and one backpressure unit, and several sets of pressure-temperature regulators. All process loads are balanced. This station is typical of modern chemical plant practice, the design being aimed at efficient use of every pound of steam and kilowatt produced. Since all energy utilized in production is reflected in the selling price, maximum energy utilization is sought.

Paper Industry

An effcient arrangement of backpressure extraction, mixed-pressure condensing, and backpressure turbines is demonstrated in Fig. 2A; this plant serves a paper mill. Daily operation requires considerable quantities of steam and electricity. Greatest demand variation occurs in 17-psig process steam to the mill. Ordinarily, exhaust from two turbines, No. 1 and 2, supplies 17-psig steam. When the mill demand decreases, turbine No. 3, a mixed-pressure condensing unit, absorbs the excess steam, exhausting it to a condenser after it passes through a portion of the turbine. Meanwhile, the governor of No. 1 turbine reduces the load on this unit, and its exhaust quantity decreases. Since power required varies with process steam needs, electrical output from the three turbines is regulated by the demand for 17-psig steam. Demand for this steam varies over a wide range because of a variety of processing operations.

Large steel plants have power stations that approach utilities in unit capacity. Smaller steel mills employ plants of the type shown in Fig. 2B, which closely approach typical industrial practice. Steam, generated at 450 psi and 750 F, flows through a 4,000 kw backpressure turbine, exhausting at 150 psi and 450 F into a desuperheater. Later it passes to process or through plant auxiliaries to a 10-psi header.

Three of the four boilers can burn oil, blast-furnace gas, or coke-oven gas. The fourth unit burns either coke breeze or blast-furnace gas. Each boiler has a rating of 125,000 lb per hr. Complete dust collecting, feedwater treating, and blowdown systems are installed in this plant.

Textile Industry

Increased production together with greater utilization of electricity processes such as weaving, spinning, dyeing, opening, drying, and bleaching have somewhat changed the textile power plant. Always large users of process steam, modern textile mills also require large amounts of electrical energy. Hence, higher steam pressures and temperatures are necessary with high-capacity boilers and turbines.

Fig. 3A shows the cycle for a recently completed cotton mill power plant. Steam at 650 psi and 750 F is generated in two 150,000 lb per hr boilers. Steam flows to a 15,000-kw extraction condensing unit, two pressure-reducing stations with a total capacity of 170,000 lb per hr, the boiler feed pumps, and another set of pressure-temperature reducers. Process steam at two pressures, 170 and 50 psi, is supplied by extraction from the turbine and by reduction from the high pressure main. Steam at 5 psi, obtained from feed-pump turbine exhaust and pressure reduction from 50 psi, heats the plant and mill buildings; also, the deaerator. Extensive water-treating facilities serve a reservoir of 20,000,000-gal capacity located on the plant site. Raw water is employed for condenser cooling before being filtered. After filtering, the water goes to a 5,000,-000-gal reservoir. Process and power-plant water, drawn from this point, is treated before being used.

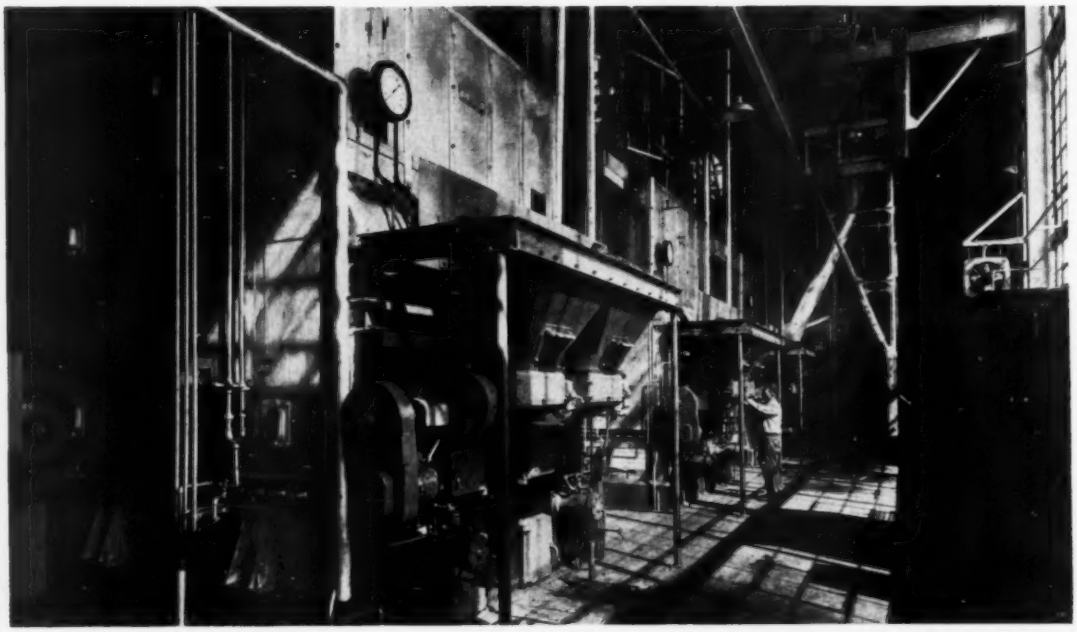
Rubber Industry

The cycle for a large synthetic-rubber manufacturing plant is shown in Fig. 3B. Five boilers, operating at 750 psi and 740 F, supply steam to a 35,-000-kw backpressure turbine, which exhausts at 155 psi and 450 F. Pressure-temperature reduction from boiler pressure also supplies process and auxiliary steam at two pressures.

Plant auxiliaries, including pumps and fans, are all driven by steam turbines operating from 155 psi and 450 F to 5 psi or vacuum, according to the service. High-pressure process condensate is flashed to 15-psi process steam. The turbine, when operating at maximum capacity of 41,000 kw, exhausts 1,200,000 lb per hr to proc-

(Continued on page 145)

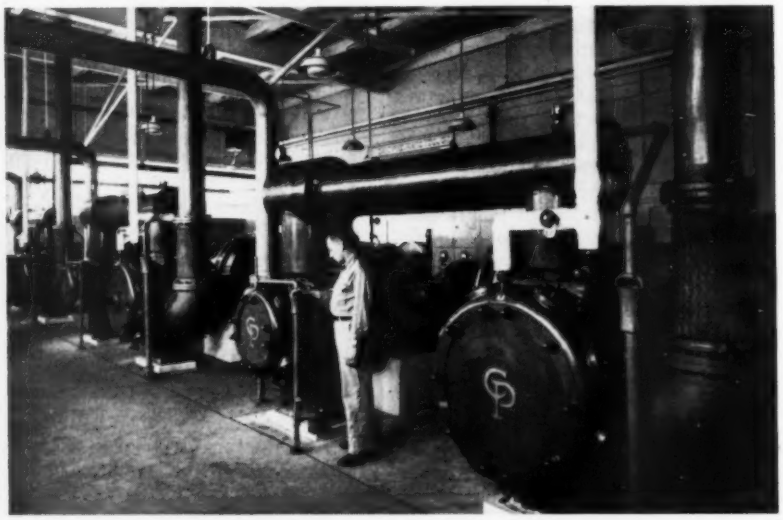
CHICAGO PNEUMATIC BOILERS MEET PLANT NEEDS WITH LOW-HEAT COAL



Spreader-stoker fired, integral-furnace boilers, rated at 20,250 lb per hr, are good for 30,000 lb per hr for 3 hr

Long-range planning for manufacturing speed on production lines was carried through on the design of power services when the boiler specifications called for units that would be able to carry the plant load with 12,200-Btu coal

When the plant is in full production, compressed-air requirements will be supplied by these three 1,650-cfm two-stage 112-psi units. Plant layout allows for future expansion of production lines and extension of power facilities

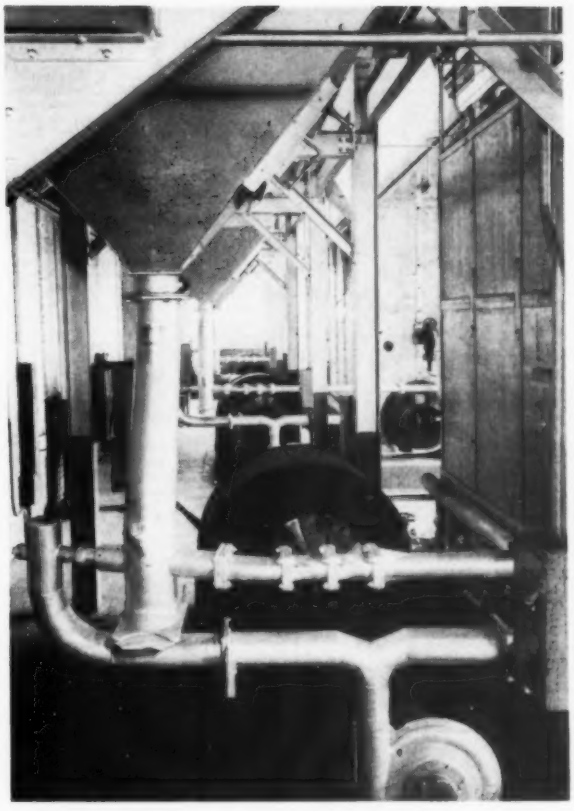


ONE OF THE MOST UNUSUAL manufacturing layouts in the entire country is nearing completion at the Chicago Pneumatic Tool Company's new plant in Utica, N. Y. The main building alone is over one-fifth mile long and nearly half as wide.

Faced with the problem of designing production lines for two basically different types of tools, CP engineers first laid out two six-acre sections; the west section to manufacture tools having a rotary action; the east section, tools with a reciprocal action. A horseshoe production line was then laid out for each operation, and the plant was actually built around the whole. This freedom of space and layout enabled plant men to devise a "similar-process" system of flow control that rivals the motor car assembly line in efficiency.

Separated from the main structure are buildings for the forge shop, plating shop, power plant, and foundry. The latter is one of the most complete

All-welded steel piping is used. Valves are tagged for easy maintenance and identification in manuals



Flyash and cinders, trapped in a dust collector, are blown back into the furnace to prevent air pollution

non-ferrous foundries to be found in any industrial plant. Designed by the National Engineering Company, the sand handling equipment and core oven installations are almost entirely mechanized.

Each division has its own air-conditioned soundproofed physical, chemical, and metallurgical laboratories and experimental shops with electronic controls and testing devices. Both sections of the plant are serviced by a conveyor system for automatically handling and processing metal chips and coolant.

The building is completely fireproofed, and all vaults are equipped with automatic CO_2 spray for preserving records from fire. Overhead conveyors, modern lighting, an auto-dial PBX telephone system, photographic darkrooms, a 500 seat cafeteria, first aid rooms, and recreation areas are the last word in industrial planning.

Future Expansion Possible

Plant layout allows for future expansion and the power facilities are arranged for easy extension. Electrical energy comes from the local utility but steam for heating and process is generated by three 20,250 lb per hr, 160 psi, integral-furnace, spreader-stoker fired boilers.

Design engineers were on their toes because they specified that boilers and stokers give required rating with 12,200-Btu coal. Performance met a real test during the recent coal strike when it became necessary to burn strip-mine coal that was almost half clay. High-heat coal is fast disappearing and good engineering was evidenced by taking the fuel situation into consideration.

Boilers are rated at 20,250 lb per hr normal, 25,000 continuous and 30,000 lb per hr for peaks up to three hours. Heating surface is 4321 sq ft with 789 sq ft in water-wall area. Grate area is 75.7 sq ft. Normal fuel consumption is 10 lb of steam per lb of coal.

Steam is generated at 100 psi and distributed throughout the plant where it is reduced to 35 psi for unit heaters, and 9 psi for hot-water converters serving several hot-water heated areas.

After erection, the boilers were cleaned by boiling them out at 50 psi with a solution containing 2600 ppm trisodium phosphate, 800 ppm sodium metasilicate and 125 ppm caustic soda. Feedwater makeup, about 10%, is of good quality and only internal treatment is needed. Amines are added to protect return lines against corrosion.

All returning condensate and makeup goes to a 60,000 lb per hr deaerating heater operating at 2 psi. Storage capacity is 3000 gal or a 20-min supply. Feed pump exhaust steam passes through an oil trap before entering the deaerator for feedwater heating.

Three horizontal - duplex, 78 - gpm pumps (rated for water at 225 F, 130 psi discharge pressure and 15 ft positive suction head) supply feedwater through water-level regulators. Governors control pump speed according to discharge pressure. Feedwater piping is brass.

Conveyorized Coal Handling

Stokers are 2-section spreader-type units 8 ft 4 in. by 10 ft 7 in. A cinder return system from the dust collector feeds trapped particles into the furnace.

Coal comes to the plant by railroad and is unloaded into a self-clearing track hopper. A 40 ton per hr apron conveyor carries it to a crusher that can be bypassed if coal is proper size. From here it goes by bucket elevator to a 300-ton overhead bunker where it is distributed by a belt conveyor and automatic tripper. Belt conveyor can be bypassed to ground storage when necessary. Gates in bunker bottom feed

PRINCIPLE EQUIPMENT IN UTICA PLANT OF CHICAGO PNEUMATIC TOOL CO.

BOILERS, integral furnace (3)	Babcock & Wilcox Co.
Casing	The National Boiler Casing Co.
Safety valves	Manning, Maxwell & Moore, Inc.
Non-return valves	Crane Co.
Stop valves	Jenkins Bros.
Blowdown valves	Babcock & Wilcox Co.
Blowdown valves	Barrett Machine Co.
Water column	Reliance Gauge Column Co.
Combustion control	Bailey Meter Co.
Soot Blowers	Diamond Power Specialty Corp.
Feedwater regulators	Northern Equipment Co.
Stokers, spreader	Detroit Stoker Co.
Coal handling system	The Jeffrey Mfg. Co.
Ash handling system	National Conveyors Co. Inc.
Dust collector	Prat-Daniel Corp.
Forced-draft fan	Clarage Fan Co.
Motor & control	General Electric Co.
Induced-draft fan	Prat-Daniel Corp.
Motor & control	General Electric Co.
Stacks	Prat-Daniel Corp.
Flyash system	Buffalo Forge Co.
Blower motor	General Electric Co.
Deaerator	Sims Co.
Feed pumps, reciprocating	Wagener Pump Co.
Governors	Kieley & Mueller Inc.
Feedwater treatment	Bird-Archer Co.
Pipe hangers	Grinnell Company, Inc.
Pipe hangers	C. H. Liebfried Mfg. Corp.
Pressure gages	Manning, Maxwell & Moore, Inc.
Recorders & draft gages	Bailey Meter Co.
Exhaust relief valve	Cochrane Corp.
Relief valves	Kieley & Mueller, Inc.
Miscellaneous valves	Crane Co.
Miscellaneous valves	Jenkins Bros.
ELECTRICAL SYSTEM	
Main & unit substation equipment (1)	General Electric Co.
(6)	Westinghouse Electric Corp.
Potheads	G & W Electrical Specialty Co.
Distribution duct	Bull Dog Electric Products Co.
Power transformers (1)	General Electric Co.
(6)	Westinghouse Electric Corp.
Miscellaneous controllers	Allen-Bradley Co.
Miscellaneous controllers	Cutler-Hammer Inc.
Miscellaneous controllers	General Electric Co.
Miscellaneous controllers	Westinghouse Electric Corp.
Lighting transformers	General Electric Co.
Lighting panels	Bull Dog Electric Products Co.
Fluorescent lights	General Electric Co.
COMPRESSED-AIR SYSTEM	
Compressors (4)	Chicago Pneumatic Tool Co.
Motors & starters	General Electric Co.
M G sets	General Electric Co.
Pipe vibration sleeves	Chicago Metal Hose Corp.
Lubricators	Manzel Inc.
Air filters & silencers	American Air Filter Co. Inc.
Ventilators	H. H. Robertson Co.
Safety valves	J. E. Lonergan Co.
Traps	Wright-Austin Co.
Valves	Jenkins Bros.
Aftercoolers	Chicago Pneumatic Tool Co.
HEATING SYSTEM	
Hot-water converters	Bell & Gossett Co.
Hot-water converters	The Patterson-Kelley Co. Inc.
Unit heaters	Modine Mfg. Co.
Valves	The Fairbanks Co.
Valves	Jenkins Bros.
Relief valves	J. E. Lonergan Co.
Relief valves	Kieley & Mueller Inc.
Pressure-reducing valves	McAlear Mfg. Co.
Pressure-reducing valves	Spence Engineering Co. Inc.
Strainers	The Trane Co.
Fans	Buffalo Forge Co.
Heating coils	Aerofin Corp.
Condensate-return pumps	The Weinman Pump Mfg. Co.
Condensate-return pumps	Warren Webster & Co.
Traps	Armstrong Machine Works
Traps	The V. D. Anderson Co.
Thermostats	Minneapolis-Honeywell Regulator Co.
Strainers	McAlear Mfg. Co.
Pressure gages	J. E. Lonergan Co.
MISCELLANEOUS EQUIPMENT	
Sump pumps	Weil Pump Co.
Sprinkler system	Automatic Sprinkler Corp. of America
Fire-hose racks	W. D. Allen Mfg. Co.
Fire extinguishers	The F-R-X Mfg. Co.
Engineers & Constructors	Walter Kidde Constructors Inc.

a 3000-lb weigh larry that delivers coal to 1500-lb hoppers on the stokers.

Ashes from dump grates are raked into collecting hoppers that feed a pneumatic conveying system leading to an outside storage. Silo is of tile construction 10 ft in dia and 17 ft high. Capacity is 20 tons.

Combustion Control

Combustion control consists of steam flow-air flow ratio controllers designed to maintain boiler pressure within a plus or minus 2% of the 100-psi operating pressure. Furnace draft is held constant by a regulator that controls boiler outlet dampers. Venturi stacks are designed to handle 37,500 lb of 520-F flue gas per hour.

Steam piping is welded steel construction and all valves carry brass tags for maintenance records and easy identification in instruction manuals. Hard drawn copper tubing serves for metering and temperature control purposes and in buildings heated with water.

Electrical power comes in over two 44-kv feeders to a 3000-kva transformer bank connected to step the voltage down to 4160/2400 for distribution within the plant to seven unit substations. These in turn step the voltage down through air-cooled transformers to either 440 or 220 v for local distribution over plug-in bus duct. Four 1000-kva and one 750-kva stations feed the plant proper while two 500-kva units take care of the foundry and power house. Lighting is supplied by 220/220-110 air-cooled transformers tapped on the plug-in bus at strategic locations throughout the plant.

Main power transformer low-tension air circuit breakers are rated 5 kv, 1200 amp with 100,000-kva interrupting capacity. Substation feeder air circuit breakers are good for 5 kv, 600 amp and same interrupting capacity. Individual 3000-amp, 600-v air breakers with 75,000 kva interrupting capacity take care of plug-in bus circuits.

Individual panels and exciters (left) serve each of the compressors illustrated on page 94, bringing them to speed and in synchronism with load requirements. Switchgear (right) uses 1,200-amp abc's having 100,000-kva interrupting capacity

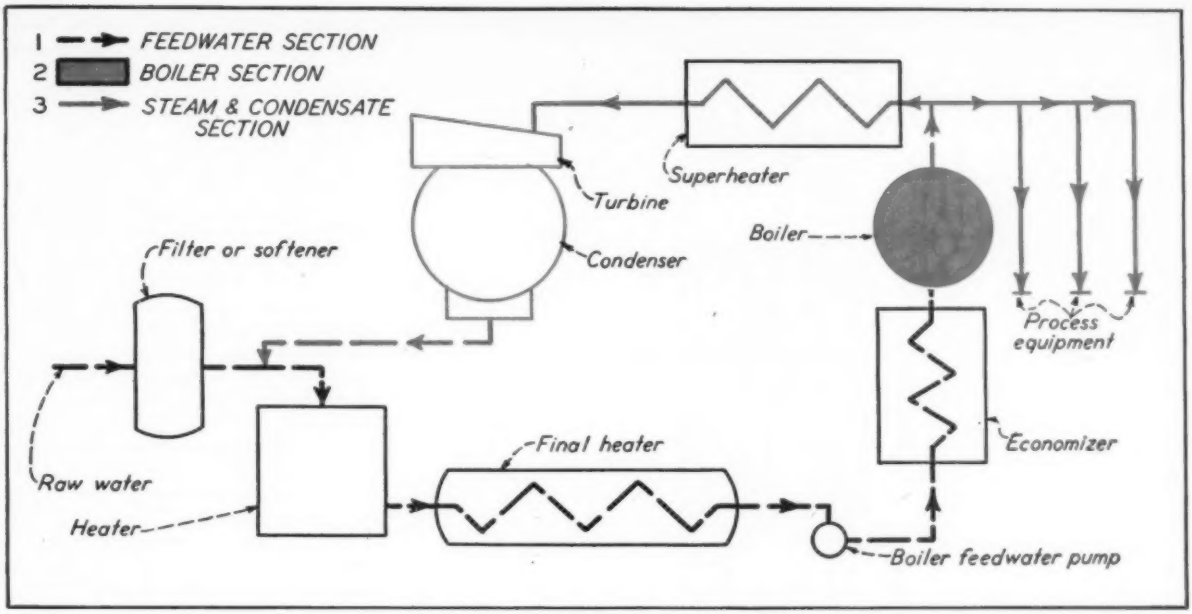


Fig. 1—Water cycle includes feedwater system, boilers, and steam and condensate piping

Solutions to Your Problems in • • • •

. . . . FEEDWATER TREATMENT

DR. R. C. ULMER, Technical Director, Power Chemicals Div., E. F. Drew & Co. Inc.

NOT MANY YEARS AGO, a little soda ash was regarded as being sufficient treatment for feedwater, where any treatment at all was desired. Maintenance of proper carbonate alkalinity in relation to the sulfate present, gave fair results at low pressure but, as pressures increased, it soon became evident that the carbonate-sulfate ratio was not enough. About this time phosphates came into use. These materials gave better results and to many it appeared that the ultimate had been reached; however, it was not long before it became evident that many problems still existed.

Chief among these were complex scales, adherent sludge, especially iron oxide, and at very high pressures certain failures bordering on corrosion. Carryover, corrosion and caustic embrittlement were present during this entire time.

Fortunately, considerable progress has been made in alleviating the above difficulties, and recent findings are summarized here to stimulate interest that may lead to solution of the remaining problems. For this discussion, the plant water cycle, Fig. 1, is divided into three parts: (1) the feedwater system, or section ahead of the boilers, (2) the boiler, and (3) the steam and condensate system.

Feedwater System

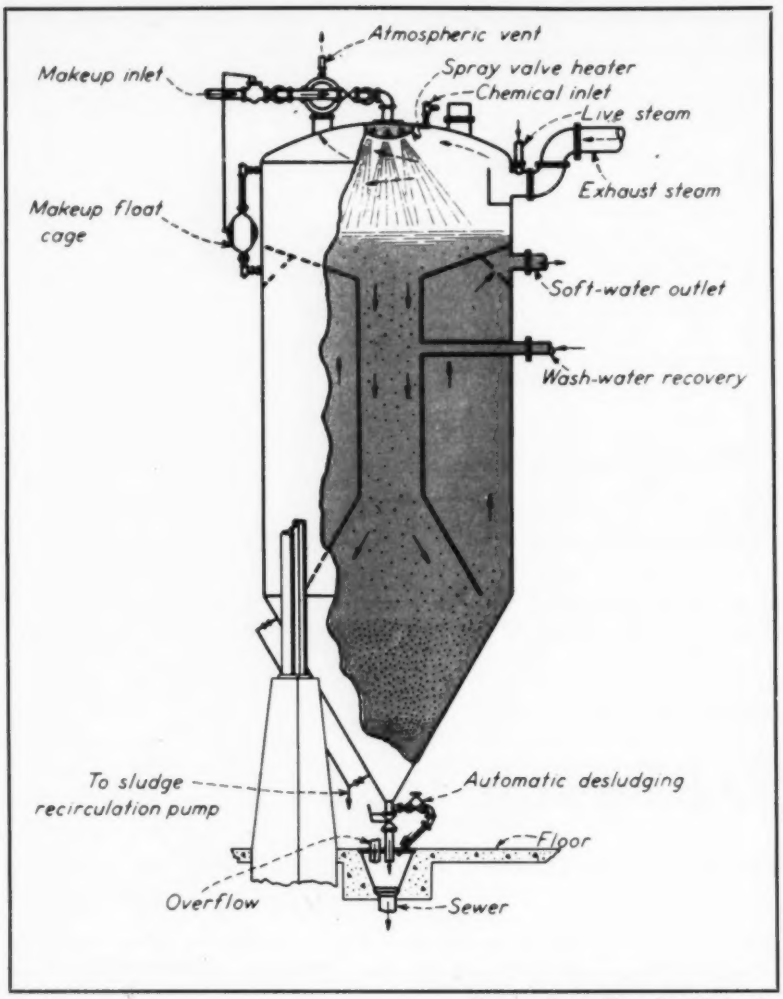
In the feedwater system we are concerned with pretreatment of the water entering the boiler—softening and/or removal of solids and deaeration, or correction of corrosive characteristics. Present trends, especially at higher pressures, are toward a more and more pure feedwater. This applies to both total solids and gases in the water.

Complete Removal of Solids. Practically all suspended and dissolved solids may be removed by either evaporation or deionization. Prior to the last few years, evaporation had the advantage over deionization of producing silica-free water. Now, however, deionizing processes remove silica, or deionized water can be treated to remove silica, and a product of about the same quality as evaporated water obtained. Cost, therefore, now is the chief consideration in deciding what method to select.

Evaporation. More consideration is now being given to chemical treatment of the makeup to evaporators to prevent scale and eliminate carryover. Phosphate-organic combinations, either with or without the usual "shocking" or "cracking" operation, have been found quite successful. Especially in the case of sea water, starch and certain organic - phosphate combinations have been found quite effective in eliminating scale. If scale does form, for example where treatment is not used, acid cleaning is being used quite generally for its removal. Antifoam agents can be used to prevent mechanical carryover.

Deionization. As stated previously, this method of producing water of "distilled" quality is becoming much more common since silica also can be removed. Like other ion-exchange materials, anion exchangers used as part of the system have a definite capacity of exchange and when exhausted must be regenerated. The higher the concentration of ions to be removed (soluble salts), the more expensive is the regeneration, and this aspect is usually the governing factor as to whether deionization can compete with evaporation.

Removal of Scale-Forming Materials. Zeolites and lime-soda processes continue to be employed generally for this purpose and there have been great improvements in both.



Courtesy, Graver Water Conditioning Co.

Fig. 2—The improved hot-process softeners, with coagulants, magnesium oxide and sludge contact produce better effluent

Zeolites. In the case of zeolites, the development of synthetic-resin types has greatly improved exchange capacity and has made possible their use with water over a wider range of pH and over a greater temperature range.

When producing hydrogen-zeolite treated water, it is possible to remove the silica readily by converting it to fluosilicic acid in which form it is readily absorbed by commercially available anion exchangers. Recent developments have indicated considerable absorption of silica, for example in 4-bed types without fluoride.

Advent of the hydrogen-zeolite cycle, usually with a sodium cycle, has made possible ready control of the alkalinity. By varying the amount of water passed through each, the desired alkalinity generally can be obtained.

Lime-Soda. Great improvements have been made in design and operation of lime-soda softeners, Fig. 2. These have resulted chiefly in lower hardness, higher capacity, and lower silica content.

In the first place, many advancements have been made in proportioning chemicals to the softener. Some electrical methods make possible adding the chemicals in direct proportion to water flow.

In order to speed up the reactions and also to make them go further to completion, coagulants are often added with the lime and soda. In settling, the floc gathers together smaller particles making them settle out faster and also making possible their removal by filtration. Sodium aluminate and magnesium oxide are the most common.

Magnesium oxide is also satisfactory for silica removal. Removal is not entirely dependent on chemical reaction and certain grades are more effective than others, while results also vary with the type of water concerned. For some waters, dolomitic lime may be used, eliminating the need for magnesium oxide.

The reverse reaction may be accomplished if too much magnesium is present. That is, silica is added to remove the magnesium. This has been found helpful where magnesium phosphate deposits have been encountered in boilers but, needless to say, discretion is important because of the possibility of introducing silica problems.

Many methods have been worked out for improving sedimentation and accelerating the reactions. Most of these involve producing a "seeding" action through the introduction of suspended matter. The suspended matter may be from boiler-water sludge, which has settled out in the softener, or a bed of calcium carbonate in the softener. Recirculation of settled sludge from the softener now is quite common. Thus, retention time is greatly reduced and lower hardness is insured.

Seeding

In addition to supplying suspended matter for "seeding", recirculation of boiler water, usually from a blowdown, also supplies alkalinity required in the softening reactions. As this alkalinity would normally be lost there is a saving of chemical. Removal of alkalinity from the recirculated water in the softener also makes possible operation of the softener with higher alkalinities without resulting in excessive alkalinities in the boiler water.

Higher alkalinity in the softener results in lower hardness in the effluent. Recirculation of boiler water also results in removal of suspended matter from the boiler water. Thus the ratio of suspended matter to soluble matter is decreased, eliminating some of the dangers of sludge and carryover.

There also has been some trend toward operation of softeners at higher pressures. This results in higher temperatures, which cause the chemicals to react faster and more completely. Lower hardness and less retention time are the chief advantages. Pressures up to 50 psi are suggested. A lime-soda softener may be modified with phosphate, either in a single-step process in place of soda ash or in a two-step process after regular lime-soda softening. In these processes, a slight excess of phosphate is carried; normally just enough to give the proper amount in the boilers.

Chief advantage of lime-soda-phosphate softeners is the very low hardness obtained. In fact, the hardness may be considered zero. These softeners have certain limitations that should not be overlooked. In the first place, in the one-step use of phosphate, cost of treatment is much greater than would

be the case with lime-soda. The two-step process, of course, eliminates this difficulty.

With either method there is some danger of deposits in feedlines, especially where increases in temperature take place, such as closed heaters and economizers. The deposits result largely from calcium phosphate coming out of solution. Organics can be used to prevent the adherence of precipitated material resulting from such "after precipitation".

Oil Removal. In the past decade, considerable advances have been made in the removal of oil from condensate. Coagulants, such as alum, have been used for some time with good success, but they have the disadvantage of contaminating the condensate. In recent years, precoated filters have given good success. Asbestos fiber or a similar filtering material is first put on the filter as a base for the activated earth that absorbs the oil. Some earth is put on the filter and other added continuously to the water from which the oil is to be removed. The earth absorbs the oil and is retained on the filter. The filtering material must be removed periodically and the filter recoated.

Another type of apparatus involves filtering the oil-containing water through a layer of wire or rope strands. The oil is retained and flows to a section where it can be drained off periodically. With such a system, practically all of the oil can be removed. Certain conditions, such as temperature, alkalinity, etc., are important and must be kept within certain limits.

Deaeration. Finally there has been much more emphasis placed on deaeration of feedwater. In fact, there appears to be a decided preference for "zero oxygen". The advent of cold-water deaeration really involves the same principles as regular deaeration at or near the atmospheric boiling point. Great care must be taken to insure removal of gases from the water at the lower temperature.

These improvements have resulted in greatly improved feedwater which should result in fewer problems in the boilers themselves, but these effects have been offset to some extent by increase in pressures and higher heat-transfer rates. Consequently, improvements have been required in boiler-water treatment.

In the Boiler

In modern boiler-water conditioning, attempts are made to eliminate, as completely as possible, the difficulties caused by scale, sludge, corrosion, and carryover. In general, the same problems exist as previously but, in recent years, some have been aggravated and

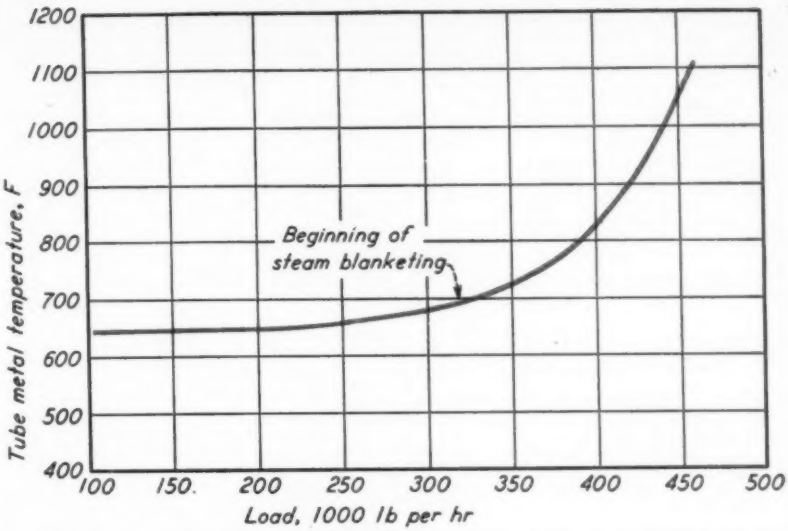


Fig. 3—Steam blanketing causes tube-metal temperature to vary with load

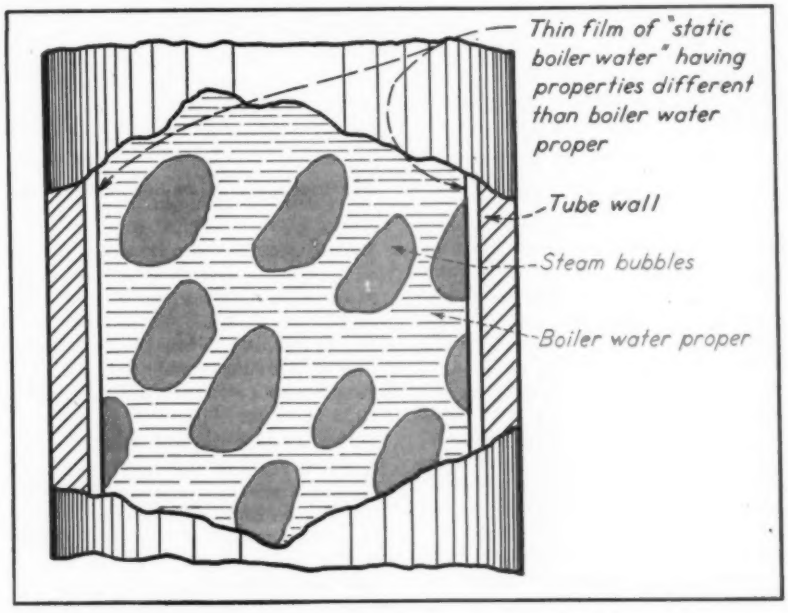

Thin film of "static boiler water" having properties different than boiler water proper
Tube wall
Steam bubbles
Boiler water proper

Fig. 4—Boiler water on tube surface concentrates with evaporation

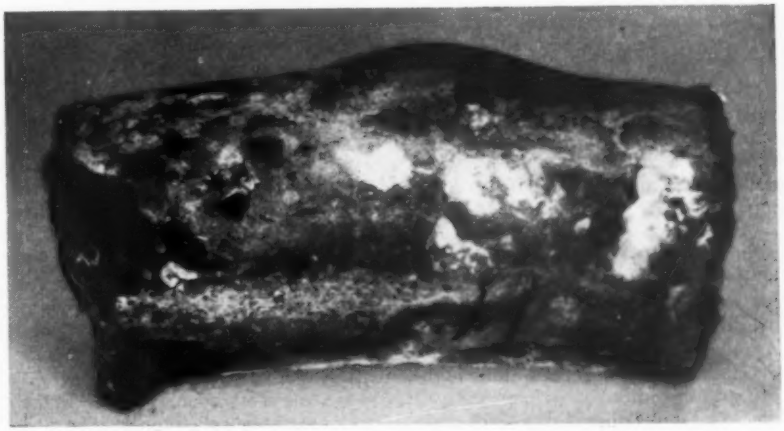


Fig. 5—Scale blocks heat transfer and overheated metal gives way

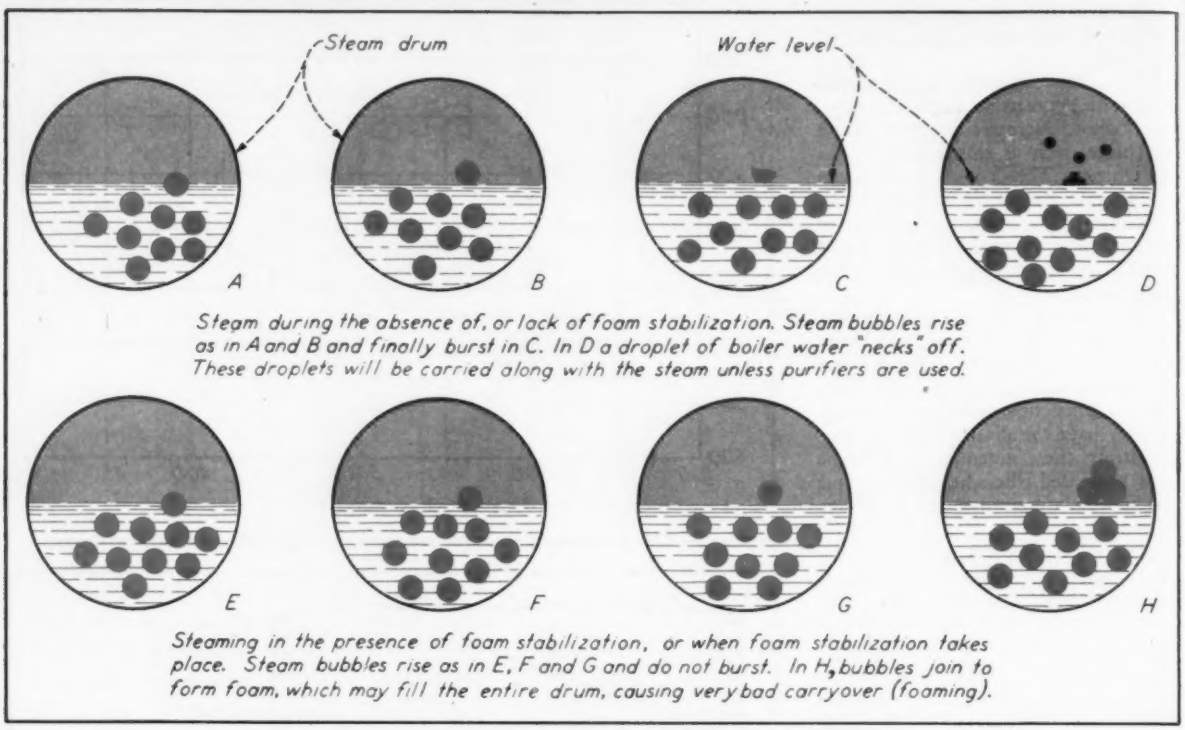

Steam drum
Water level
A
B
C
D
Steam during the absence of, or lack of foam stabilization. Steam bubbles rise as in A and B and finally burst in C. In D a droplet of boiler water "necks" off. These droplets will be carried along with the steam unless purifiers are used.
E
F
G
H
Steaming in the presence of foam stabilization, or when foam stabilization takes place. Steam bubbles rise as in E, F and G and do not burst. In H, bubbles join to form foam, which may fill the entire drum, causing very bad carryover (foaming).

Fig. 6—Certain impurities make steam-bubble film tough, and foam forms

brought into prominence owing to increased pressures.

Too little consideration has been given to what takes place at the water-tube metal interface when steam is generated. As shown in Fig. 4, it should be emphasized that, in the steam-generation area, the tube metal is covered with a film of "boiler water" and this boiler water becomes more concentrated as steam is generated. Moreover, the concentration of materials in this film cannot be controlled appreciably by blowdown. Rather, the concentration is governed almost entirely by the particular solids present, the temperature increment at the interface, and the pressure.

Circulation and rating have the chief effects on altering the characteristics of the water film at the interface. These factors, therefore, must be considered when trouble occurs. Since the various salts behave differently, consideration also should be given to the boiler-water composition when correcting troubles.

Another condition, sometimes lost sight of, is the change of temperature of the water and saturated steam with pressure. Table 1, shows the values over the pressure range 0 to 2,800 psi. As 400 psi is sometimes used as the dividing line between low- and high-pressure operation, it is interesting to note the temperature change over these pressure ranges. It will be noticed that the temperature increase with change in operating pressure is 236F over the range 0 to 400 psi and 238F over the range 400 to 2,800 psi. These values merely indicate the rate of change, and the fact that the actual temperature is the important thing, should not be lost sight of.

Still another factor is the fact that, as steam pressure increases, the difference between the density of the boiler water and steam decreases. This is because steam density increases rapidly with pressure, Table 1. Since circulation is promoted by this difference in density, it may be expected that circulation will be poorer the higher the pressure. Again, this factor must be taken into consideration in the cases of failures, especially at high pressures.

Scale. The common carbonate and sulfate scales have been practically eliminated through the use of phosphates. Maintenance of 20 to 50 ppm excess PO_4, along with the proper alkalinity will, in practically all cases, eliminate objectionable scale of these types even at high pressures.

This, unfortunately, is not true with silicate scales. These are of three general types, (1) calcium or magnesium silicate, (2) complex sodium or potassium aluminum silicates and (3) practically pure silica (SiO_2). Type (2) causes the most trouble; types (1) and (3) usually being eliminated by maintenance of proper excess phosphates and alkalinity. Fig. 5 shows a typical failure of a tube containing such scale.

In an effort to eliminate the problems relating to complex aluminum-silicate scales, some high-pressure plants have resorted to potassium treatment on the theory that the potassium compounds would remain in solution at high temperatures. Varying results have been obtained.

Surface-active materials, especially of the protective colloid type, have found wide application in dealing with this type of scale. The action of these materials is to coat the particles of silicate as they precipitate, rendering them non-adherent.

Once these complex silicates deposit in the boiler they are very difficult to remove. Turbining usually is ineffective as the materials are hard and glassy. About the only successful method of removal is chemical cleaning and this usually involves the use of fluorides. As such cleaning procedures are troublesome, and usually not too successful, every attempt should be made to prevent this type of scale.

Oil in condensate returns continues to be a problem, especially where engines are involved. The action of oil is much the same as scale, but in addition the oil may cause carryover. Best remedy, of course, is to keep oil out of the boiler as discussed previously, but if this is not possible or practical, it can be absorbed by the use of a proper

coagulant in the boiler. With this procedure, the sludge must be removed regularly by blowdown, otherwise there may be danger of the oil-sludge mixture baking on the surfaces.

Sludge originates from materials precipitating from the water. Especially in the high-heat-transfer areas, the sludge may adhere and cause pretty much the same difficulties as scale, unless the sludge is properly conditioned. By use of a small amount of surface-active materials, for example an organic, the sludge is made non-adherent and it will continue circulating with the boiler water until it can be removed by blowdown.

With certain types of water, magnesium sludges may be a problem. The phosphate often precipitates, especially at low alkalinities and adheres to the heat-transfer surfaces. Some attempts have been made to remove the magnesium by adding silica to the boiler water with good reported results. The method has not been accepted widely because of the danger of difficulties from silica. A better practice appears to be the conditioning of such sludges with a surface-active material.

In recent years, especially in high-pressure boilers, a new sludge problem has developed. Usually the sludge consists of a mixture of iron oxide, copper, and small amounts of precipitated material from the boiler water. A typical analysis is given in Table 2.

Under certain conditions, especially in high-heat-transfer areas, this type of sludge "bakes on" causing failures similar to those from scale. The source of the iron usually is corrosion in the return or feedwater system, although in rare cases it may be present in the makeup water. The copper usually originates from corrosion of brass or copper in the steam or return system.

Eliminating difficulties from adherent sludges, such as referred to in Table 2, is often possible by eliminating the chief constituents, namely iron oxide and copper. Corrosion preventive means are required. If the source of these materials cannot be eliminated, the sludge usually can be made non-adherent with a surface-active material.

Corrosion. Corrosion in the boiler proper has been decreased greatly, owing to improved methods of deaeration of the feedwater, and to the fact that the usual alkaline treatment for scale prevention is effective in preventing corrosion. The general types are:

Pitting, or corrosion resulting from dissolved oxygen, is readily controlled with oxygen scavengers and to some extent by inhibitors of the film-forming type. Action of the latter is greatly supplemented by a proper organic in combination with the inhibitor.

Acid corrosion is rarely a problem, unless there is contamination in some process operation. In such a case, the remedy to be preferred is to stop the source of contamination or to discard the water containing the contamination. If this cannot be done, alkali can be fed to neutralize the acid, but this may lead to carryover.

More attention is now being given to "alkaline corrosion". Especially in high metal-temperature areas, an alkaline boiler water may dissolve the iron oxide film on the metal surface, thus permitting corrosion to take place. This type of corrosion is commonly found where poor circulation exists, or where steam blanketing, Fig. 3, takes place. The solution often lies in eliminating these difficulties. Proper boiler-water conditioning also will aid greatly in combatting this type of trouble. Elimination of all free alkali and maintaining proper pH through "captive alkalinity", i.e. phosphates or silicates, is sometimes resorted to.

TABLE 1—VARIATION OF STEAM DENSITY AND TEMPERATURE WITH PRESSURE

Pressure, psi	Saturated-Steam Temperature, deg F	Saturated-Steam Density, lb per cu ft
0	212	—
400	448	0.894
1200	569	2.830
2000	637	5.390
2800	686	9.920

TABLE 2—CHEMICAL ANALYSIS OF INNER SCALE

Moisture, per cent	0.40
Analysis on a dry basis, per cent:	
Ignition loss	4.66
Silica	2.07
Copper oxide	25.91
Lead oxide	0.64
Iron oxide	16.05
Aluminum oxide	12.66
Nickel oxide	1.59
Calcium oxide	Trace
Magnesium oxide	4.57
Zinc	17.45
Phosphorous pentoxide	10.58
Chloride, as chlorine	Trace
Sulfur trioxide	0.64
Alkalies (by difference)	2.97

Another type of alkaline corrosion is referred to as intergranular corrosion or caustic embrittlement. The causes have been dealt with generally in the current literature. It now appears that the ASME embrittlement ratio is of questionable value for prevention of embrittlement, with the possible exception of pressures below 100 psi. Sodium nitrate appears to be the most practical material for general use. Tannins and lignins also are effective, but objectionable color may be imparted to the water. Bureau of Mines publications have dealt explicitly with preventive treatments and means for testing for embrittling tendency.

Owing to the presence of copper in sludges removed from boilers, corrosion in the boiler has often been attributed to the copper. This feeling has been augmented by the fact that films of metallic copper are often found in boilers after acid cleaning. Regardless of these facts, there appears to be little real evidence that copper has actually caused appreciable corrosion when the boiler water is treated properly. Of course, in low pH waters, corrosion will take place. If a pH of 10.5 and over is always maintained there appears to be no danger from copper.

With the advent of higher pressures, a different type of corrosion has been encountered, which usually results in a small section being blown from the tube. The section near the failure is often brittle. In some cases the corrosion appears to have taken the form of pitting. "Barnacles" are sometimes found in the pits. Cause of the failures appears somewhat questionable but localized corrosion is common to all.

In some cases, the corrosion appears to have been accelerated by breakdown of the iron-oxide film by an acidic condition, possibly by acid cleaning. In others, alkali attacking the film appears to have caused the localized action. Galvanic action, between the barnacle or corrosion product and the base metal, may or may not be a factor. It appears that in all cases, diffusion of hydrogen into the metal at high temperatures reacts with the iron carbide, weakening it and causing the steel to be brittle.

Corrective measures appear to be elimination of factors that will promote localization of corrosion, e.g. dissolved oxygen, insufficient or excessive alkalinity. Stated in another way, the boiler-water treatment should be such as to promote a continuous protective film on the metal.

Carryover

Carryover denotes the contamination of steam with boiler water from foaming, priming, entrainment, etc. The

(Continued on page 157)

AUTOMATIC SPEED CONTROLS MEET VARIED REQUIREMENTS

FRANCIS A. WESTBROOK

Variable-speed changers, properly applied, can effect important economical savings in transmitting power in textile, paper, sheet metal, wire and veneer plants. Applications to which this type of power transmission unit can be adapted are: synchronization of separate machines or parts of one machine; uniform peripheral speeds in winding operations; and maintaining uniform pressure, liquid level or temperatures for industrial processing

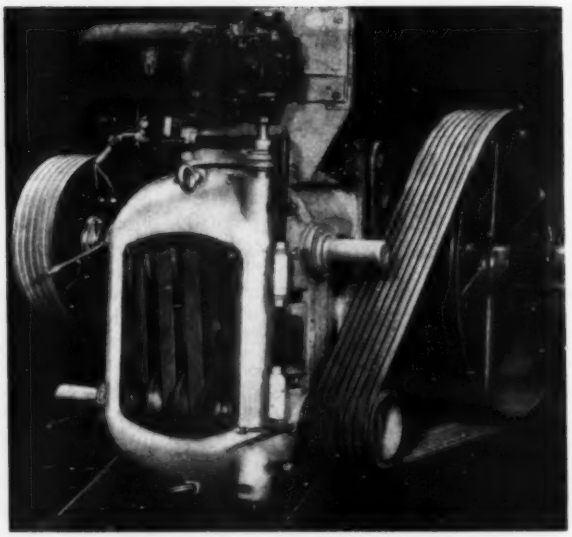


Fig. 1 — Constant-tension blocker consists of standard V-belts, torque sheave and speed changer that is connected to a constant-speed motor — Courtesy Allis-Chalmers Mfg. Co.

APPLICATION of automatic controls to mechanical variable-speed power transmissions or speed changers has, in many instances, resulted in important economies. For example, in a certain veneer mill, three lathes equipped for automatic speed control have equalled the production formerly secured from four lathes.

Automatic speed control is also employed with marked success in a diverse variety of industries which include paper, textiles, sheet metal, wire, veneer, and chemicals. Such an installation on a textile finishing range reduces machine operation to two men, rather than the eight men previously employed. Great improvements in quality and important reductions in wastage have also been realized.

There are three broad operating classifications to which automatic speed control is applicable: (1) synchronization of separate machines and of different parts of one machine; (2) maintaining constant tension or uniform peripheral speeds in winding operations; and (3) maintaining uniform pressure, weight, liquid level, temperature, or other variable elements. These are discussed later in this article.

Automatic regulation is obtained by a number of methods, depending on the type of machine or operation involved, and include hydraulic, mechanical, electrical, float, and differential controls. Brief consideration of a few specific applications will show how automatic speed regulation works out in practice.

Automatic stokers are an excellent example of equipment with controlling force strong enough to operate a speed changer direct, by mechanical means, to regulate speed of a travelling grate and assure correct steam pressure. When the steam pressure drops a pressure regulator, connected through an extended lever to the variable speed transmission unit or speed changer, causes an increase in grate speed and subsequent fuel consumption, resulting in greater steam pressure and supply.

The extended lever attached to the variable speed unit may be connected to any suitable moving element of a machine, either directly, by cable, to follower rolls, air or steam actuated regulators, or cutting knives of veneer lathes. This type of control requires more mechanical energy for operation than hydraulic control demand.

Specific Applications

Fig. 1 shows an interesting application of automatic speed regulation by maintaining a relatively constant tension on the winding roll, or blocker, as a thin strip of metal is rolled. As the diameter of the roll increases the tension on the strip will increase unless the speed of the roll is correspondingly decreased. If the speed is not decreased, the strip will stretch and might eventually break, as the travel through the thinning rolls is constant.

Automatic control consists of a special torque sheave keyed to the input shaft of the speed changer with the rim and web supported on needle bearings on the hub. The two units are linked together through a compression spring. The blocker, as tension is increased, transmits power to the input shaft of the speed changer—operated at 800 to 900 rpm. This causes a slight movement between the constant ten-

sion rim and the torque sheave hub, thus compressing the spring. Movement is communicated to a microswitch on the sheave web, and the circuit closes when the slip rings contact the carbon brushes located on the speed changer case. With the closing of the circuit, the pilot motor is energized and actuates the speed control mechanism, and in this instance the result would be a slowdown. The microswitch closes with as little as .001 in. movement so the tension on the metal strip is very closely controlled.

When a strip has been wound on the blocker, the operator presses a button, and the pilot reverses the motor to return the blocker to the correct starting speed. A limit switch is installed to regulate starting speed. Design of the torque sheaves is such that tension of the strip may be adjusted during winding process if desired.

Controls Pumping Units

Another interesting automatic speed control method is contained in a pilot motor (Fig. 2). The installation was made by the Milwaukee Sewage Commission for pumping sewage. Three motor driven pumps, each with an individual speed changer, operate from one control—a float-operated device located in an incoming sewage well.

Since the amount of incoming sewage varies, the rate of pumping from the well must be correspondingly varied. The control is actuated by the float, measures the sewage level and slows down or speeds up the pilot motors that drive adjusting shafts on the speed changers. The control cuts one or more pumps out on low well level, and starts the pumps when the level rises.

A speed changer (Fig. 3) was installed in a chemical plant to control the pump supplying city water for processing. Water pressure in this plant must be held at a fairly constant level. As the city water pressure often varies, the pump controls are set to maintain a constant discharge pressure even though the suction pressure changes. Low and high pressure limit switches maintain the discharge pressure between the limits set on each switch. The pressure actuated switches operate a pilot motor, reversing the starter and adjusting the speed changer shaft.

Maintains Uniform Tension

Differential automatic control units can also maintain uniform tension and constant peripheral winding or unwinding speeds and synchronize two or more machines. The differential is similar in principal to the differential of an automobile. A standard unit consists of differential gearing mounted on the middle shaft with 1:1 gear and chain ratios driving between the center and two outside shafts. When the two outside shafts are driven at the same speed, and in the same direction, the middle shaft is idle. However, if the two outside shafts are not the same speed the middle shaft will rotate.

To obtain automatic control, the two outside shafts are connected to the driven machine, and the middle shaft is connected to the speed changing screw of a standard variable speed drive. Thus, when the speed of the driven machine varies from the desired speed the middle shaft of the differential rotates and turns the speed changing adjustment of the variable speed unit.

This method of power transmission is applicable for maintaining constant tension on a web of strip material such as paper, wire and cloth. Either outside shaft of the differential is connected to a source of power, and the other outside shaft fits into the variable speed transmission input shaft. The middle shaft is connected to the speed changing screw of the variable speed unit. The two outside shafts will rotate at the same speed when the system is in balance, provided of course that the proper ratio for the connecting drives to the differential have been selected.

As the diameter of the wind-up roll builds up, the material speed increases and the system becomes unbalanced. This occurs because the material is delivered at constant speed and a torque is created in the wind-up roll drive. Torque is transmitted through the variable speed unit to the so-called "slip-belt" between the source of power and the variable speed unit input shaft. The "slip-belt" will only carry a predetermined load set by the tension idler. When the load is exceeded the belt begins to slip, or creep, which causes a speed decrease in the differential outside shaft to which it is connected. The middle shaft of the differential will then rotate and shift the changing screw of the variable speed transmission to a lower wind-up roll speed. Whenever a change in tension is desirable, even during a given run, the weight on the tension idler is adjusted.

Each application must, of course, be designed to meet specific requirements, but the basic system can be adopted to almost any combination of materials, speed, and space requirements.

This is a two part article; the second part will appear in the July issue.

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Fig. 2 — Pump with automatic float speed control installed in a disposal plant maintains a constant liquid level in the acid-house well — Courtesy Allis-Chalmers Mfg. Co.

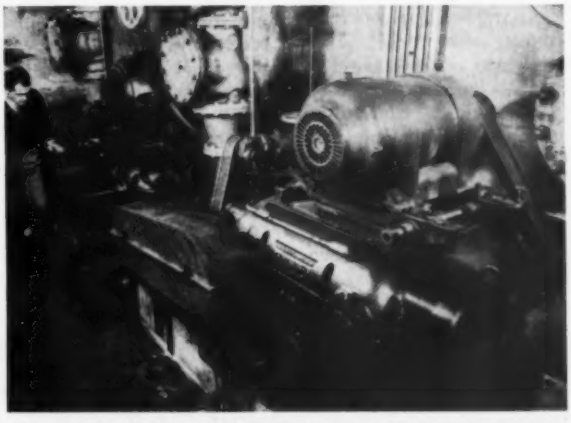


Fig. 3—Speed changer, installed on pump to maintain water pressure in a chemical plant, is actuated by a high and low pressure switch — Courtesy Allis-Chalmers Mfg. Co.

For installations like this, symbols are a part of the concise, graphical language designers employ to convey ideas to installation engineers

SYMBOLS FOR HEAT-POWER APPARATUS DEVELOPED FOR DESIGN WORK BY ASA

COMPILATION of forty-four graphical symbols* for heat-power apparatus has been approved by the American Standards Association as a new American Standard (Z32.2.6-1950). This is the sixth of a group of revisions and expansions of an existing standard: "American Standard Graphical Symbols for Use on Drawings in Mechanical Engineering (Z32.2-1941)".

Many leading power companies and their representatives throughout the country were consulted and a careful study was made to avoid conflicts with symbols being assembled by committees in allied fields. Clarity, simplicity, and nation-wide acceptance were basic considerations in assembling the symbols. Symbols used only in limited areas are omitted, the forty-four shown being a minimum requirement.

This standard has been developed by the ASA sectional committee on "Standardization of Graphical Symbols and Abbreviations for Use on Drawings, Z32." Work of the committee is under the joint sponsorship of the AIEE and the ASME. Following approval of the sectional committee, sponsor organizations, and the ASA, this proposal was designated as an American Standard on February 23, 1950.

The ASA sectional committee on "Standardization of Graphical Symbols and Abbreviations for Use on Drawings," is comprised of a number of subgroups, each working on particular projects. Subgroup No. 7 compiled the forty-four graphical symbols for heat-power apparatus shown on the opposite page. Personnel of Subgroup No. 7 is as follows; J. M. Barnes, Chairman, engr. in charge of drafting, Philadelphia Electric Co.; C. G. Bjork, cons. design mgr., Stone & Webster Engrg. Corp.; S. A. Chambers, Almirall & Co., Inc.; Bureau of Ships, Code 350, Department of the Navy, Washington, D. C.; G. F. Habach, ch. engr., Centrifugal Engrg. Div., Worthington Pump & Machinery Corp.; M. L. Jones, design div., engrg. dep't., E. I. du Pont de Nemours & Co.; R. von Fabrice, designing engr., electric engrg. dep't., Public Service Electric & Gas Co.; A. O. White, Turbine Generator Engrg. Div., General Electric Co.; Frank H. Smith, standards engr., drafting div., Elliott Co.

*Extracted from American Standard Graphical Symbols for Heat-Power Apparatus (ASA Z32.2.6-1950), with permission of the publisher, The American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y.

AMERICAN STANDARDS FOR PLANT ENGINEERS, DESIGNERS AND DRAFTSMEN

Title	Number
Graphical Symbols for Heat-Power Apparatus	Z32.2.6-1950
Graphical Symbols for Heating, Ventilating, and Air-Conditioning	Z32.2.4-1949
Graphical Symbols for Pipe Fittings, Valves, and Piping	Z32.2.3-1949
Graphical Symbols for Plumbing	Z32.2.2-1949
Graphical Symbols for Railroad Use	Z32.2.5-1950
Graphical Symbols for use on Drawings in Mechanical Engineering	Z32.2-1941
Graphical Symbols for Welding and Instructions for Their Use	Z32.2.1-1949
Drawings and Drafting Room Practice	Z14.1-1946
Engineering and Scientific Charts for Lantern Slides	Z15.1-1932; reaffirmed 1947
Time Series Charts	Z15.2-1938; reaffirmed 1947
Engineering and Scientific Graphs for Publications	Z15.3-1943; reaffirmed 1947
Abbreviations for Scientific and Engineering Terms	Z10.1-1941
Abbreviations for use on Drawings	Z32.13-1946
Scheme for the Identification of Piping Systems	Z13-1928; reaffirmed 1947

These Heat-Power Apparatus Symbols Involve Revisions and Expansion of Existing Standard

1 COMPRESSOR

1.1 ROTARY

1.2 RECIPROCATING

1.3 CENTRIFUGAL

M—Motor
T—Turbine

2 CONDENSER

2.1 BAROMETRIC

2.2 JET

2.3 SURFACE

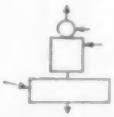
3 COOLER OR HEAT EXCHANGER

4 COOLING TOWER

5 DEAERATOR

5.1

5.2 WITH SURGE TANK



6 DRAINER OR LIQUID LEVEL CONTROLLER

7 ENGINE

7.1 STEAM

7.2

S—Supercharger
D—Diesel

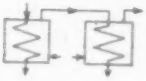
7.3

G—Gas

8 EVAPORATOR

8.1 SINGLE EFFECT

8.2 DOUBLE EFFECT



9 EXTRACTOR

10 FAN-BLOWER

M—Motor
T—Turbine

11 FILTER

12 FLOW NOZZLE

13 FLUID DRIVE

14 HEATER

14.1 AIR
(Plate or Tubular)

14.2 AIR (Rotating Type)

14.3 DESUPERHEATER

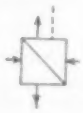
14 HEATER (Con't)

14.4 DIRECT CONTACT FEED-WATER

14.5 FEED WITH AIR OUTLET

14.6 FLUE GAS REHEATER
(Intermediate Superheater)

14.7 LIVE STEAM SUPERHEATER OR REHEATER

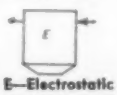


15 LIQUID LEVEL CONTROLLER

(See Item 6)

16 ORIFICE

17 PRECIPITATOR



E—Electrostatic
M—Mechanical
W—Wet

18 PUMP

18.1 CENTRIFUGAL AND ROTARY

Letters denote service

F—Boiler feed
S—Service
D—Condensate
C—Circ. water
V—Air
O—Oil
M—Motor
T—Turbine
E—Steam engine
G—Gas engine
D—Diesel engine

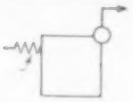
18.2 RECIPROCATING

18 PUMP (Con't)

18.3 DYNAMIC (Air Ejector or Eductor)

19 SEPARATOR

20 STEAM GENERATOR
(Boiler with Economizer)



21 STEAM TRAP

22 STRAINER

22.1 SINGLE

22.2 DOUBLE

23 TANK

23.1 CLOSED

23.2 OPEN

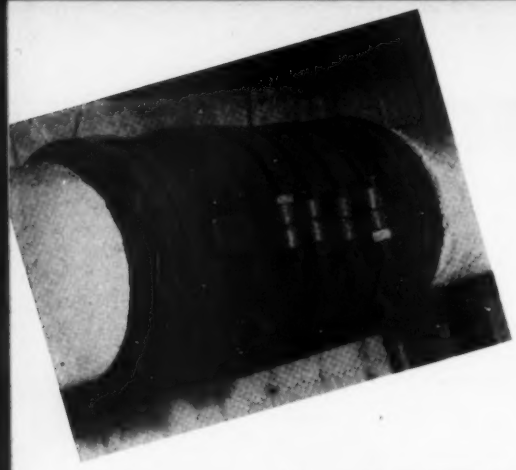
23.3 FLASH OR PRESSURE

24 TURBINE

24.1 CONDENSING

24.2 STEAM TURBINE OR AXIAL COMPRESSOR

25 VENTURI TUBE



How to select.....

CORRUGATED EXPANSION JOINTS

A. B. WHITE, Associate Editor, In Collaboration With Chicago Metal Hose Corporation, Expansion Joint Division

Here are expansion data and engineering information for choosing and applying the proper joint to the individual job. Figures are presented to simplify expansion calculations for any length of pipe

WHEN temperature changes occur in pipe lines carrying steam, hot liquids and hot gases, it becomes necessary because of expansion to make allowances for changes in pipe-line length. This is done by utilizing pipe loops, swing joints, slip joints, and corrugated expansion joints. Design improvements in the latter, particularly in recent years, permit their use at extremely high pressures and temperatures, as well as in large sizes.

Corrugated expansion joints, when used within their limits, have certain advantages over other types. Their initial cost may be lower, installation is easier, and piping layouts can be streamlined for appearance, space-saving and convenience. They are relatively trouble free in operation and require no maintenance. The saving in space over the pipe loop is, of course, obvious. Elimination of manholes in underground installations, elimination of large supports in the open, weight reduction of pipe line, and the ability to accommodate axial and lateral motion,

Free-flexing joints, Fig. 1, absorb motion, vibration at low pressure. Control rings in Fig. 2 allow up to 300 psi at 1400 deg F while integral ring types, Fig. 3, have still higher limits. Dual joints, Fig. 4, made in all these types, are best for lateral motion. Bolting or welding end connections are optional

Fig. 1

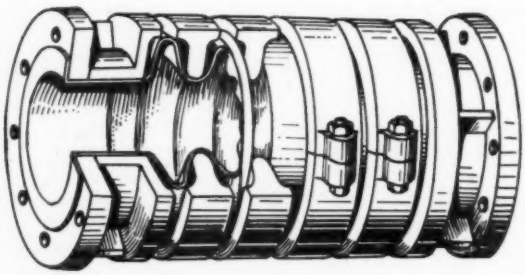


Fig. 2

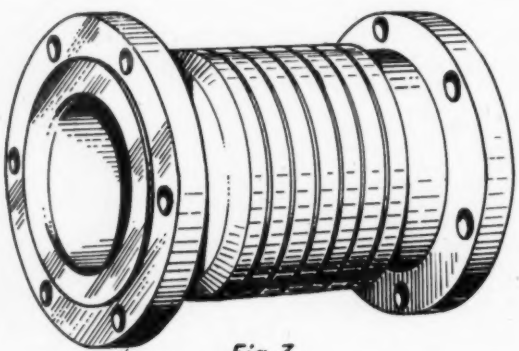


Fig. 3

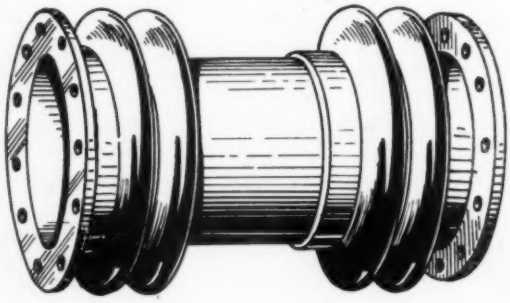


Fig. 4

as well as misalignment, are additional factors affecting selection of corrugated expansion joints for pipe lines carrying hot fluids or gases.

Types of Corrugated Joints

While variations in the design of standard corrugated expansion joints are frequently employed to meet special conditions, only two basic types are used in average installations:

1. The free flexing joint, which is suitable for vacuum installations, for pressures up to 30 psi, and for temperatures ranging from minus 300 F to plus 1,400 F (1600 F with liner). It is available in single or double types, as shown in Figs. 1 and 4, respectively.

2. The controlled flexing joint, which has the flexible corrugated member reinforced by circumferential rings, as shown in Fig. 2. It will handle pressures up to 300 psi, temperatures up to 1,400 F, (1600 F with liner) and is available in single and double types.

The trend today is toward higher pressures and temperatures. To meet these conditions, the integral-ring high-pressure joint, shown in Fig. 3, has been designed. Installations for pressures exceeding 1500 psi have been made.

All of these joints are available with flanged end connections, as shown in Figs. 2 and 4, for bolting into the pipe line; also, they may be obtained with welding ends as shown in Fig. 1.

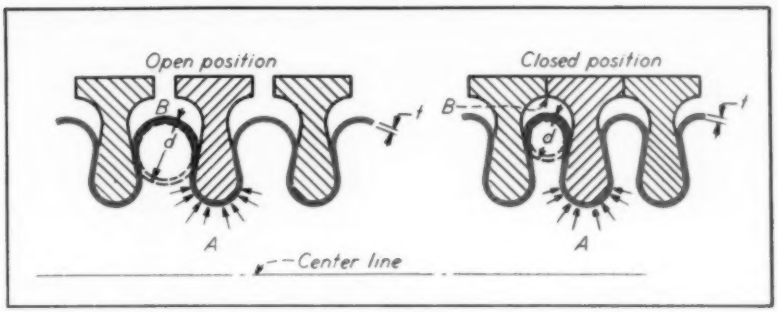


Fig. 5—Control rings prevent distortion and support corrugated member, making bursting force effective only on small diameter d

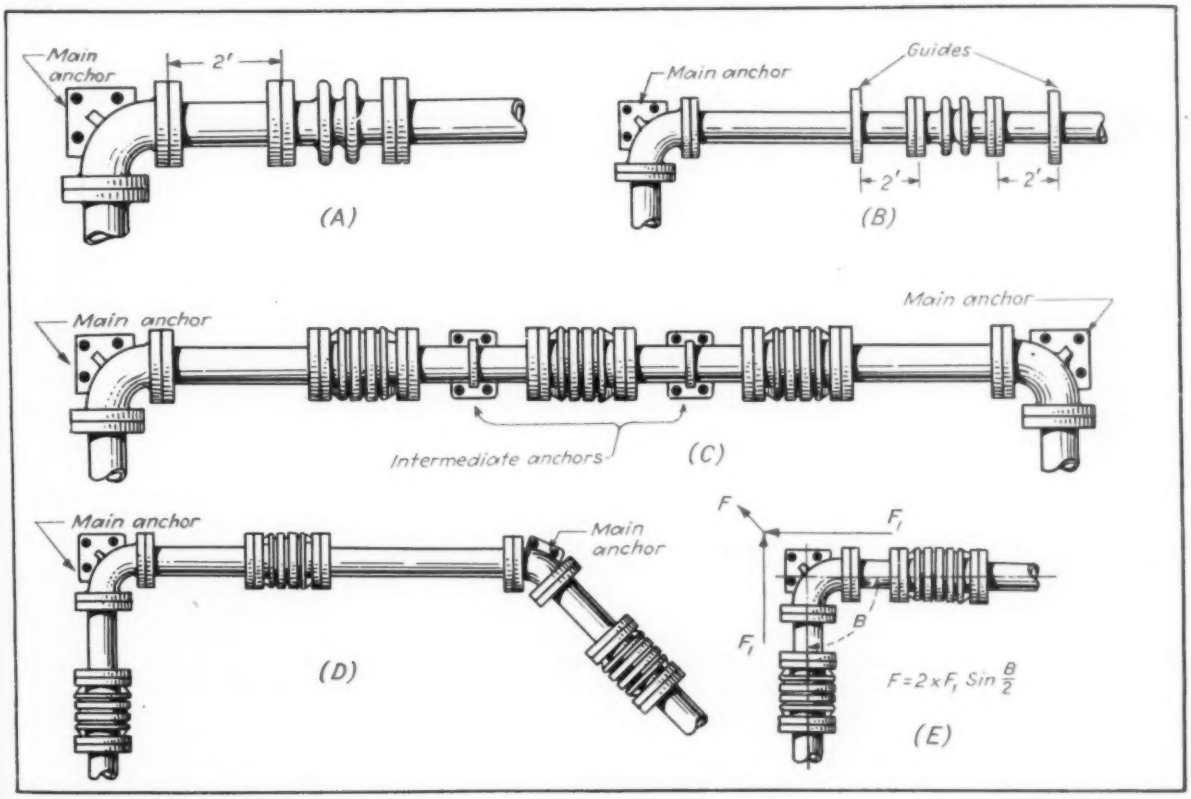
Corrugated joints may be obtained with or without liners designed to provide streamlined flow and avoid turbulence and friction. Liners may be used also to insulate partially the corrugated sleeve, thereby permitting higher temperatures and pressures in the pipeline.

Selection of Joints

To select the most suitable compensating device for pipeline expansion, the exact amount of change in the lineal dimensions of the piping system must be computed. The change in the peripheral dimensions of the pipe due to temperature variation is of little significance. The increase in axial length of the pipe is an important factor in the selection of the expansion joint required. Since the coefficient of expansion is not constant throughout the temperature range, the actual expansion for 100 ft of pipe has been computed for various materials most commonly used in piping design. These figures are listed in Table 1. The expansion for a pipe line of given length and material can be easily calculated therefrom.

For example, for steel pipe operating

Fig. 6—Joints are installed near anchors (A) or supplied with guides (B). Intermediate anchors in (C) insure that joints compress their rated shares. Each change of direction (D) requires a joint. Anchor force in (E) is vector sum of line thrusts



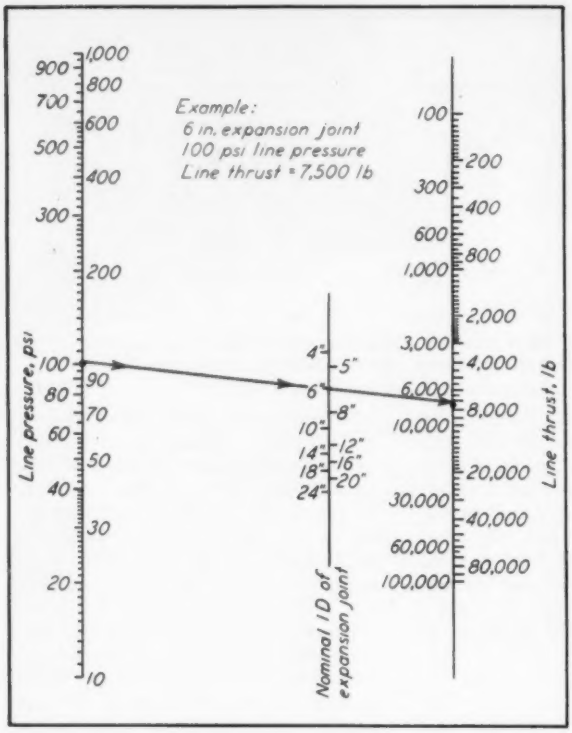


Fig. 7—Find line pressure on left and draw line through pipe size in center. Line thrust is read at intersection on right and applied in Fig. 6E

between 20 and 420 F, it is found that

Expansion at 420 F = 3.566 in.
Expansion at 20 F = 0.293 in.

The difference = 3.273 in.

which is the increase in length for 100 ft of pipe. Other lengths are in proportion. For example, the increase for 250 ft of pipe would be

3.273 x (250/100) or 8.18 in.

Even without offset or vibration, two joints capable of absorbing one-half, or 4.09 in. expansion each, would probably be required in 250 ft of pipe. The number of corrugations for each joint would vary from fourteen for 4-in. pipe to six for 24-in. pipe.

Offset, or lateral misalignment, is permitted up to 1/16 in. per corrugation, but at least two corrugations must be used and additional allowances are made where both offset and thermal expansions are involved. Table 2 shows how the number of corrugations varies with combined offset and axial motion or expansion.

Dual joints can handle greater lateral motions than single joints. For lateral motion only, a long unit having few corrugations at each end may be selected. For confined spaces, or greater thermal expansion, a short nipple with more corrugations at each end will be more satisfactory. Dual joints should have the nipple anchored as in the case of two single joints, *except* where used to handle lateral motion.

Vibration introduces fatigue effects in the corrugated member, which may reduce the allowable stress by more than one-half. However, the effects will depend on the amplitude, direction and frequency of the vibration; and actual calculation becomes too complicated to be handled here. But it should be noted that allowances are made for severe vibration in addition to those made for expansion and offset.

Free flexing joints are used frequently in exhaust systems where the internal pressure is low and vibration is the principal consideration.

TABLE 1 — THERMAL EXPANSION OF DIFFERENT TYPES OF PIPE

Saturated steam — Vacuum, In. Hg.	Saturated steam — Pressure, psig	Temp., deg. F	Elongation, in. per 100 ft — Cast-iron pipe	Steel pipe	Wrought-iron pipe	Copper pipe
		−20	0	0	0	0
		0	0.127	0.145	0.152	0.204
		20	0.255	0.293	0.306	0.442
		40	0.390	0.430	0.465	0.655
29.39		60	0.518	0.593	0.620	0.888
28.89		80	0.649	0.725	0.780	1.100
27.99		100	0.787	0.898	0.939	1.338
26.48		120	0.926	1.055	1.110	1.570
24.04		140	1.051	1.209	1.265	1.794
20.27		160	1.200	1.368	1.427	2.008
14.63		180	1.345	1.528	1.597	2.255
6.45		200	1.495	1.691	1.778	2.500
	2.5	220	1.634	1.852	1.936	2.720
	10.3	240	1.780	2.020	2.110	2.960
	20.7	260	1.931	2.183	2.279	3.189
	34.5	280	2.085	2.350	2.465	3.422
	52.3	300	2.233	2.519	2.630	3.665
	74.9	320	2.395	2.690	2.800	3.900
	103.3	340	2.543	2.862	2.988	4.145
	138.3	360	2.700	3.029	3.175	4.380
	180.9	380	2.859	3.211	3.350	4.628
	232.4	400	3.008	3.375	3.521	4.870
	293.7	420	3.182	3.566	3.720	5.118
	366.1	440	3.345	3.740	3.900	5.358
	451.3	460	3.511	3.939	4.096	5.612
	550.3	480	3.683	4.100	4.280	5.855
	664.3	500	3.847	4.296	4.477	6.110
	795.3	520	4.020	4.487	4.677	6.352
	945.3	540	4.190	4.670	4.866	6.614
	1115.3	560	4.365	4.860	5.067	6.850
	1308.3	580	4.541	5.051	5.268	7.123
	1525.3	600	4.725	5.247	5.455	7.388
	1768.3	620	4.896	5.437	5.660	7.636
	2041.3	640	5.082	5.627	5.850	7.893
	2346.3	660	5.260	5.831	6.067	8.153
	2705	680	5.442	6.020	6.260	8.400
	3080	700	5.629	6.229	6.481	8.676
		720	5.808	6.425	6.673	8.912
		740	6.006	6.635	6.899	9.203
		760	6.200	6.833	7.100	9.460
		780	6.389	7.046	7.314	9.736
		800	6.587	7.250	7.508	9.992
		820	6.779	7.464	7.757	10.282
		840	6.970	7.662	7.952	10.512
		860	7.176	7.888	8.195	10.814
		880	7.375	8.098	8.400	11.175
		900	7.579	8.313	8.639	11.360
		920	7.795	8.545	8.867	11.625
		940	7.989	8.755	9.089	11.911
		960	8.200	8.975	9.300	12.180
		980	8.406	9.196	9.547	12.473
		1000	8.617	9.421	9.776	12.747

Design Considerations

Because a relatively thin, flexible corrugated member is employed, its ability to withstand internal pressure will generally receive first consideration. However, the pipe line, expanded by heat, compresses the corrugations, and vibration and offset induce other stresses, all of which combine with the bursting force to produce a resultant stress which will determine the thickness and the number of corrugations. Temperature will reduce the yield point of the material and therefore limit the safe working stress. On the other hand, the corrosive action of the fluid or gas carried by the pipeline may determine the joint material and therefore, the allowable stress.

Temperature will usually, in fact, be the determining factor in choosing the material because copper joints are limited by code to 400 F at 25 psi for free-flexing and 200 psi for controlled flexing. Stainless steel may be used up to 900 F at 30 psi for free flexing and 300 psi for controlled flexing joints, and up to 1,400 F at reduced pressures. Where liners are used, their insulating effect may reduce the actual temperature of the corrugated member several hundred degrees and sometimes raise the permissible temperature or pressure. Type 347 stainless steel generally is used for high-temperature service because of its stability at elevated temperatures and because of its excellent corrosion resistance.

Bursting strength may be calculated by Barlow's formula, based on code for pressure piping, after the material of the pressure carrying member has

been chosen. Barlow's formula, which gives results on the high side of safety, is

$$P = 2St/d$$

Where P = bursting pressure, psi
S = allowable stress (stainless steel —80,000 psi)
t = wall thickness, in.
d = outside diameter, in.

The effect of bursting pressure will be understood more easily by studying Fig. 5. Cross sections, in both the open and closed positions, show that the reinforcing rings are designed to give smooth, controlled bending to the membrane and to prevent crushing and distortion in either position. Hoop stresses from internal pressure, which are ordinarily proportional to the diameter of the pipe, are carried by the reinforcing rings at A and do not materially affect the thickness of the membrane. Rather, the stress developed is equal to that in a tube of diameter *d* at *B* in the sketches. An example of the stress calculation on a 24 in. diameter stainless steel joint is

$$P = 2St/d$$
$$= (2 \times 80{,}000 \times .078)/2.250$$
$$= 5{,}550 \text{ psi.}$$

Based on a 300 psi working pressure, the factor of safety is

$$5{,}550/300 = 18.5$$

In the closed position, where the pipe is expanded by heat, d is smaller and the safety factor will be higher unless the temperature has decreased the yield point of the membrane material. For smaller joint diameters, the membrane is, in general, proportionately heavier and the safety factor higher.

Control rings are generally made of nickel cast iron although other materials may be chosen for extremes of temperature and pressure.

Elasticity of the corrugated member permits the joint to absorb the expansion of the pipe line, lateral displacement and vibration. Any or all of these factors set up bending stresses which are directly proportional to the displacement and inversely proportional to length of the joint. In other words the larger the displacement from all factors taken together, the longer the joint, and the more corrugations required, to keep the stresses within safe limits.

Methods of Application

Anchors and guides must be used in pipe lines containing expansion joints to insure axial motion without lateral stresses. Fig. 6 illustrates several important points in their application as follows:

(A) Joints should be installed within 2 ft of an anchor.

(B) Where it is necessary to install joints midway between anchors, guides should be provided within 2 ft of each end of the joint.

(C) Where two or more joints are required in a straight run, an intermediate anchor is required. When this is

Fig. 8—Typical applications. Only pipe material, temperature and length need be known to find expansion. Sample calculation in center shows a joint with a 4⅜ in. traverse is needed in the 175 ft length in lower left corner

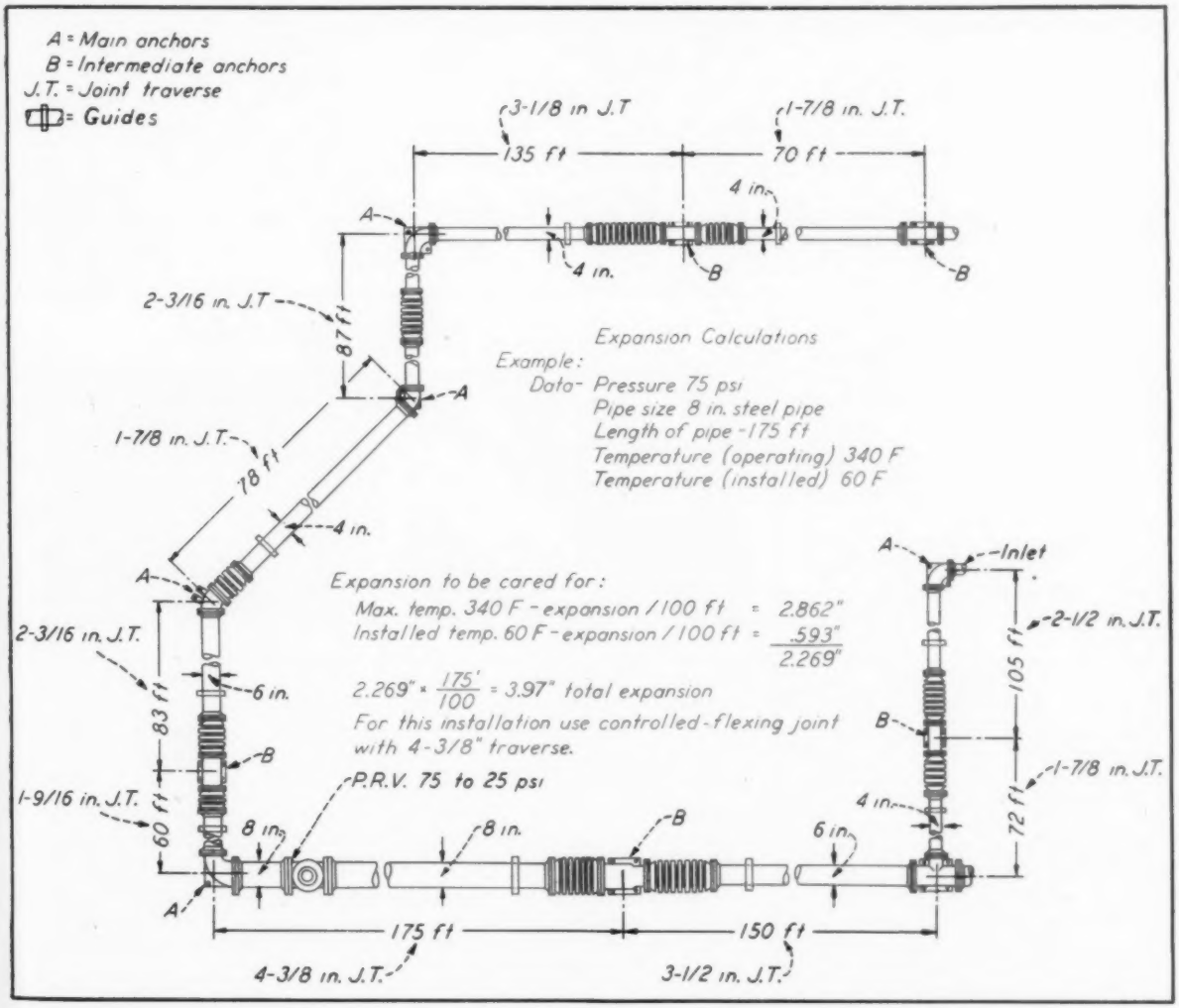


TABLE 2 — NUMBER OF CORRUGATIONS REQUIRED FOR LATERAL OR COMBINED AXIAL AND LATERAL MOTION

Size, in.	Axial motion, in.	Lateral motion, in.* 1/16	1/8	3/16	1/4	5/16	3/8	1/2	3/4	1
4	0	3	4	4	5	5	6	7	8	10
	1/4	3	4	5	5	6	6	7	9	10
	1/2	4	5	5	6	6	7	8	9	11
	3/4	4	5	6	6	7	7	8	10	11
	1	5	6	6	7	7	8	9	10	12
	1 1/2	6	7	8	8	9	9	10	11	13
	2	8	8	9	9	10	10	11	12	14
	2 1/2	9	10	10	11	11	12	12	14	—
	3	11	11	12	12	12	13	14	—	—
5	0	3	4	5	5	6	6	7	9	10
	1/4	3	4	5	6	6	7	8	9	11
	1/2	4	5	6	6	7	7	8	10	11
	3/4	4	5	6	7	7	8	9	10	12
	1	5	6	7	7	8	9	9	11	12
	1 1/2	6	7	8	9	9	10	10	12	—
	2	8	9	9	10	10	11	11	—	—
	2 1/2	9	10	10	11	11	12	—	—	—
	3	11	11	12	12	—	—	—	—	—
6	0	2	4	4	4	5	5	6	7	8
	1/4	2	4	4	4	5	5	6	7	8
	1/2	4	4	4	5	5	6	6	7	8
	3/4	4	4	5	5	6	6	7	8	9
	1	4	4	5	5	6	6	7	8	9
	1 1/2	4	5	6	6	6	7	8	9	10
	2	5	6	6	7	7	8	8	9	10
	2 1/2	6	6	7	8	8	8	9	10	11
	3	7	7	8	8	9	9	10	11	12

Size, in.	Axial motion, in.	Lateral motion, in.* 1/16	1/8	3/16	1/4	5/16	3/8	1/2	3/4	1
8	0	2	3	4	4	4	5	5	6	7
	1/4	2	3	4	4	4	5	6	7	8
	1/2	3	4	4	4	5	5	6	7	8
	3/4	3	4	4	5	5	5	6	7	8
	1	3	4	4	5	5	6	6	7	8
	1 1/2	4	4	5	5	6	6	7	8	9
	2	4	5	6	6	6	7	7	8	9
	2 1/2	5	6	6	7	7	7	8	9	—
	3	6	6	7	7	8	8	8	9	—
10	0	2	3	4	4	5	5	6	7	8
	1/4	3	4	4	4	5	5	6	7	8
	1/2	3	4	4	5	5	6	6	7	8
	3/4	3	4	4	5	5	6	6	8	9
	1	4	4	5	5	6	6	7	8	9
	1 1/2	4	5	5	6	6	6	7	8	9
	2	5	5	6	6	7	7	8	9	—
	2 1/2	5	6	6	7	7	8	8	9	—
	3	6	6	7	7	8	8	9	—	—
12	0	2	3	3	4	4	4	5	6	6
	1/4	2	3	3	4	4	4	5	6	7
	1/2	2	3	4	4	4	5	5	6	7
	3/4	3	3	4	4	4	5	5	6	7
	1	3	4	4	4	5	5	6	6	7
	1 1/2	3	4	4	5	5	6	6	7	8
	2	4	4	5	5	6	6	6	7	8
	2 1/2	4	5	5	6	6	6	7	8	8
	3	5	6	6	6	6	7	7	8	9

Size, in.	Axial motion, in.	Lateral motion, in.* 1/16	1/8	3/16	1/4	5/16	3/8	1/2	3/4	1
14	0	2	3	3	4	4	4	5	6	7
	1/4	2	3	4	4	4	4	5	6	7
	1/2	3	3	4	4	4	5	5	6	7
	3/4	3	4	4	4	5	5	6	6	7
	1	3	4	4	4	5	5	6	7	8
	1 1/2	4	4	4	5	5	6	6	7	8
	2	4	4	5	5	6	6	7	8	8
	2 1/2	4	5	5	6	6	6	7	8	9
	3	5	6	6	6	7	7	8	8	9
18	0	2	3	4	4	4	5	5	6	7
	1/4	2	3	4	4	4	5	5	6	7
	1/2	3	4	4	4	5	5	6	7	8
	3/4	3	4	4	5	5	5	6	7	8
	1	3	4	4	5	5	6	6	7	8
	1 1/2	4	4	5	5	6	6	6	7	8
	2	4	5	5	6	6	6	7	8	9
	2 1/2	5	5	6	6	7	7	7	8	9
	3	5	6	6	7	7	7	8	8	9
24	0	2	3	4	4	4	5	5	6	7
	1/4	3	4	4	4	5	5	6	6	8
	1/2	3	4	4	5	5	6	6	8	8
	3/4	3	4	4	5	5	6	7	8	9
	1	3	4	5	5	6	6	7	8	9
	1 1/2	4	4	5	6	6	6	7	8	9
	2	4	5	6	6	6	7	8	9	—
	2 1/2	5	5	6	7	7	7	8	9	—
	3	5	6	7	7	7	8	8	—	—

* Offset motion, ends remaining parallel. Motion to one side of center line.
NOTE: For any lateral motion, more than one corrugation must always be used.

done, each joint will absorb its share of expansion.

(D) An expansion joint must be installed with each change of direction in the line.

Anchors must be strong enough to carry the weight of the pipeline. In addition, all anchors must be able to withstand the reaction force (spring action of the corrugated member) necessary to compress the joint its full rated axial motion. This force, *Fe*, is 200 x ID in inches for copper and 300 x ID for stainless steel. For free flexing joints of more than one corrugation, the values may be cut in half, or 100 x ID for copper and 150 x ID for stainless steel.

Corner, or main anchors, also have a force, *Fp*, equal to the internal pressure multiplied by the internal effective area of the joint acting upon them from two directions. The effective area of the joint is greater than the internal area at the minimum diameter because of the thrust on the side walls of the corrugations.

The total thrust, *F*, caused by the line on one side of the elbow is the sum of the two forces, *Fe* and *Fp*. This total is most conveniently found by using the nomograph in Fig. 7.

However, the actual force on the anchor is the vector sum of the total thrusts on *both* sides of the elbow and is calculated as shown in Fig. 6E. Where a T-connection is used, the difference in thrust between the larger and smaller of the in-line branches is used as the value of one force and the thrust of the right-angle branch as the other, the result being found as before.

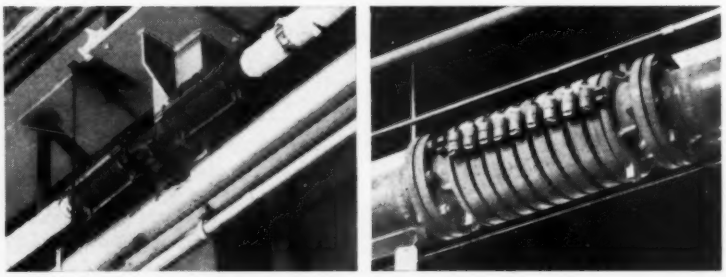
In extreme cases, where a liquid is traveling at high velocity, the centrifugal force developed as it changes direction at an elbow may become appreciable. The trust, *Fc*, may be computed from the formula:

$$(2AYV^2 \times \sin B/2)/32.2$$

where
B = change of direction, deg.
A = inside area of pipe, sq ft
Y = density of fluid, lb per cu ft
V = velocity, ft per sec

Typical applications of the joints are illustrated in the piping plan in Fig. 8. The traverse value, or the amount a joint must compress to absorb the expansion of 175 ft of pipe line is found as in the sample calculation in the center of this illustration. It is found to be 4 3/8 in. Since the expansion depends only on temperature and material, the traverse values for other lengths will be in direct proportion to the 2.269 in. per 100 ft.

INSTALLATION INSTRUCTIONS



Some corrugated expansion joints are equipped with permanent alignment bars (left) which must remain on the joints if the latter are to operate properly. When shipped, spacers are placed between the control rings, and the alignment bars are screwed down tight with cap screws. When installing, it is necessary only to loosen the cap screws and remove the control-ring spacers.

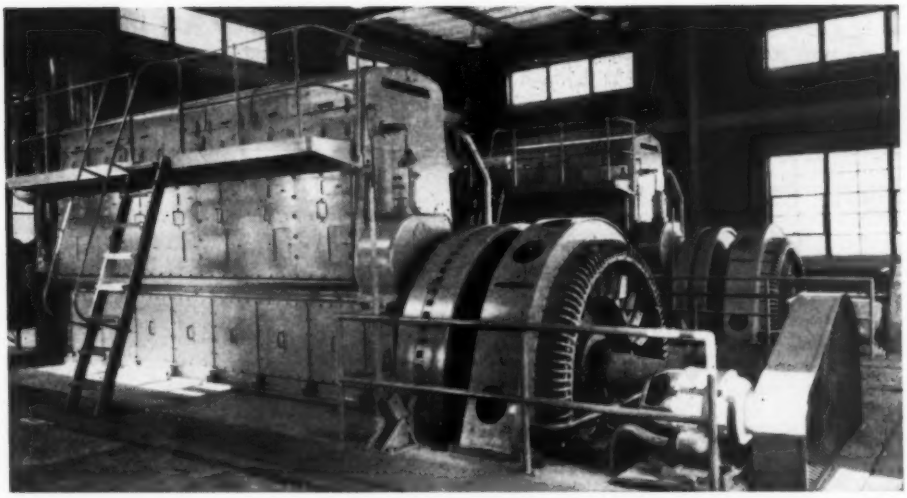
Other corrugated joints are shipped with spacers and removable shipping rods. During installation, both the spacers and the rods must be removed to permit the joint to function properly.

Remove any foreign material that may have become lodged between corrugations. To be sure this has been done, inspect the joint carefully after installation. Failure to observe this simple rule will often prevent proper operation of the joint.

Bangor Hydro-Electric Co. has installed four new diesels in the Milford, East Machias and Eastport power stations. Two more units will be added to insure service in adverse periods

Milford plant—the largest of Bangor Electric's three diesel plants—was built especially to house the new diesels and auxiliary filters, pumps and coolers

DIESELS IN A HYDROELECTRIC SYSTEM



Two 1,425-hp diesels at the Milford plant provide Bangor Electric with 2,000 kw of dependable power to supplement the hydro supply

IN THE PAST YEAR, the Bangor Hydro-Electric Co., serving 145,000 people over a large area of Maine, installed four Nordberg diesel engines totaling 5,700 hp to augment its large hydro supply and insure continuation of the company's unbroken record of service to consumers under all conditions. Additional diesel engines are on order for installation this winter. Located in three widely separated plants, the new engines also provide standby protection in the event of transmission-line failure.

The prime movers chosen for the three plants are of heavy-duty four-cycle type, each with seven cylinders, 16-in. bore and 22-in. stroke, developing 1,425 hp at a moderate 327 rpm. To achieve this rating, the four engines are equipped with exhaust-driven turbochargers. Each diesel drives directly a three-phase, 60-cycle, 4160-v 1,000-kw generator with 20-kw belted exciter.

The Milford plant, about 15 miles north of Bangor on the Penobscot River, is integrated with the company's big hydro plant in that locale; a separate wing was built to house the two Nordberg diesels installed in this plant. The East Machias plant — about 90 miles away, is located on the East Machias River between Hadley Lake and the Ocean. Here again there is a hydro plant (900 kw under normal conditions), but the diesel is housed in a separate building. Eastport, the easternmost city in the United States is some 30 miles north and east of East Machias. In this plant, the diesel is the sole electrical power producer.

Except for differences dictated by local conditions, accessory equipment and handling of fuel, lube and water are identical for the three plants. All have adequate fuel storage: four 20,000-gal tanks at Milford and three 20,000-gal tanks for each of the other stations. No. 2 fuel oil is used at all three stations. It is unloaded into storage tanks by motor-driven 125-gpm pumps. At Milford, it flows from storage by gravity through twin strainers and a meter into 300-gal day tanks located in the engine room. Later it is drawn through duplex filters to the diesel injection system by engine-driven gear pumps. A level gauge with low-level alarm has been installed on each day tank. East Machias and Eastport plants are similar except fuel is supplied to the day tanks by float-controlled motor-driven transfer pumps. Such a pump is available for use at Milford should the need arise.

Company engineers clearly recognize the importance of keeping lubricants free of contamination. Lube oil for each engine passes through twin strainers and duplex cartridge-type filters. In addition, each power unit is served by a purifier embodying an electric heater and Fuller's earth filtration elements. A motor-driven pump draws oil from the engine sump, puts it through the purifier and returns the clean oil to the sump. All bearings are lubricated by a pressure system, which also serves to cool the pistons. An oil cooler is included in the circuit. A motor-driven auxiliary lube-oil pump is operated before starting and after shutting down the engine. It is started automatically if the engine lube pressure drops. When the engine is operating, cylinders are supplied with lube oil by separate force-feed lubricators.

Cooling Water

Cooling water handling varies from plant to plant; in every case, however, a closed system is employed. At Milford and East Machias, jacket water is circulated through each engine and a separate heat exchanger by a 350-gpm motor-driven centrifugal pump.

At Milford, raw water is drawn from the Penobscot River through twin strainers by a pair of motor-driven

centrifugals, put through the heat exchangers and then returned to the river.

At East Machias, jacket-water handling is the same but raw water is drawn from the hydro penstock, run through the heat exchanger and discharged to the river. A motor-driven centrifugal pump also can be placed in service to provide raw water.

Eastport lacks the convenient and abundant source of fresh cooling water available at the other two plants; therefore the decision was made to install an evaporative cooler. Water is circulated through engine jackets and cooler coils by a motor-driven centrifugal pump. Automatic thermostatic controls keep the water at desired temperature by bypassing the cooling coils.

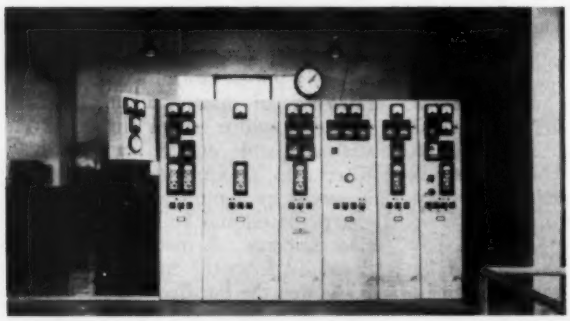
Exhaust gases drive the turbocharger and are vented through vertical silencers on the roof. Each silencer is jacketed so engine intake air can be warmed during cold weather. This air is drawn through oil-bath filters in the engine rooms by the turbocharger, and supplied under pressure to the cylinders on the intake stroke of the pistons. Supercharging resulted in a 50% increase in engine horsepower rating.

Pressure and temperature gauges and an exhaust pyrometer are mounted conveniently on each engine. Alarms have been incorporated for cooling water and lube-oil temperatures and pressures. Starting air for all the engines is provided by motor-driven compressors automatically controlled to keep air tanks at 250 psi. At East Machias and Eastport, the air compressors can also be belted to small gasoline engines. The dead-front, unit-type switchboards are well equipped and include electrically operated circuit breakers. Battery systems at East Machias and Eastport provide power for operation of the switchgear and emergency lighting.

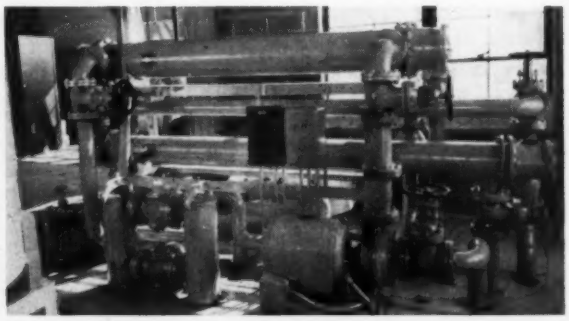
Each engine with its generator and exciter is mounted on a floating concrete slab supported by 16 vibro-isolators (each with nine springs) and four mechanical snubbers. Flexible joints have been installed in the exhaust, intake air, oil and water piping.

LIST OF PRINCIPAL EQUIPMENT AT MILFORD, EAST MACHIAS, EASTPORT DIESEL STATIONS OF THE BANGOR HYDRO-ELECTRIC COMPANY

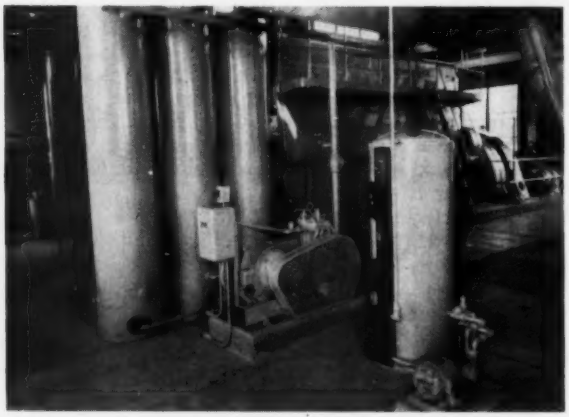
Engines	Nordberg Mfg. Co.
Generators	General Electric Co.
Governors	Woodward Governor Co.
Starting air compressors	Gardner-Denver Co.
Water pumps	Allis-Chalmers Mfg. Co.
Evaporative cooler	Worthington Pump & Machinery Corp.
Heat exchangers	Ross Heater & Mfg. Co., Inc.
Lube oils	Tide Water Associated Oil Co.
Lube oils	Standard Oil Co.
Lube oil purifiers	Honan-Crane Corp.
Lube oil coolers	Ross Heater & Mfg. Co., Inc.
Lube oil filters	Wm. W. Nugent & Co., Inc.
Auxiliary lube pumps	Blackmer Pump Co.
Auxiliary lube pump motors	General Electric Co.
Cylinder lubricators	Manzel Inc.
Fuel oil unloading pumps	Goulds Pumps Inc.
Fuel oil strainers	Elliott Co.
Fuel oil level gauges	Rochester Mfg. Co., Inc.
Fuel transfer pumps	Blackmer Pump Co.
Fuel oil filters	Wm. W. Nugent & Co., Inc.
Air filters	American Air Filter Co., Inc.
Turbo-chargers	Elliott Co.
Exhaust silencers	Maxim Silencer Co.
Alarm systems	Viking Instruments, Inc.
Switchboards	General Electric Co.
Pyrometers	Illinois Testing Laboratories, Inc.
Pressure Gauges	J. E. Lonergan Co.
Batteries	The Electric Storage Battery Co.
Outboard bearings	Dodge Mfg. Corp.
Expansion joints	Burgess-Manning Co.
Vibro isolators and snubbers	The Korfund Co., Inc.
Radio telephones	General Electric Co



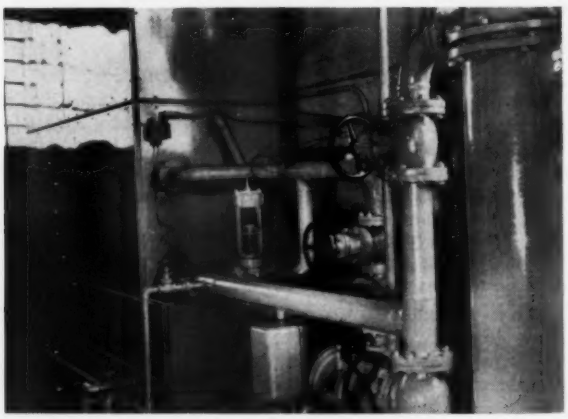
Compact switchboard, East Machias, holds full complement of instruments and electrically operated circuit breakers



Lube oil strainer and cooler, auxiliary and jacket water pumps, and heat exchanger are grouped for easy operation



Motor-driven air compressor and oil purifier are identical at the Milford, East Machias and Eastport stations



Evaporative cooler—with automatic thermostatic controls—furnishes water for the Nordberg diesel at Eastport plant

Plant Engineer's Handbook

COMPILED BY GENE FELLER

SCREW CONVEYORS

WILBUR G. HUDSON, Consulting Engineer

WHEN a screw conveyor is contemplated, it is advisable for the man in the plant responsible for selection to consider three points: (1) type of material handled, (2) path and length of conveyor and (3) capacity (amount of material to be handled).

Material Handled

If the material is actively abrasive or corrosive, the screw type may not be satisfactory. Wet ashes will quickly destroy the usual steel-plate helix and trough. Some stringy materials, such as wood chips with bark strips, spent licorice root, cotton waste and bagasse may be troublesome because they wind around the spindle or jam between helix and trough. Where moisture comes in contact with the helix, there will be trouble with gypsum, cement, or other materials that harden and bind the screw tightly. Once set, such material must be chipped out.

For lumpy material, the helix diameter must be suited to the size of lumps, regardless of capacity, as in Table 1. Lumps larger than 3½ in. will cause trouble—primarily because of jamming at intermediate hanger bearings, which results in an overloaded or stalled conveyor.

Path and Length

When the path is inclined, screw-conveyor ratings decrease sharply as seen in Fig. 1. The practical limit is about 25 deg for standard pitch screws. The machine is intended for short lengths, and when the length is greater than 100 ft, special construction (heavier tube, spindle and couplings) may be necessary.

The maximum torque is readily calculated from the horsepower, approximated by the formula:

$$Hp = CLWF/33{,}000$$

Where: C is the capacity of the conveyor, cu ft per hr
L is the conveyor length, ft
W is the weight of the material, lb per cu ft
F is the material factor, which varies from 1.2 to 4, depending on the resistance or friction coefficient of the material against steel or cast iron.

But for load requirements less than 2 hp, multiply the result by 2; for between 2 and 4 hp, multiply by 1.5. If the length exceeds 100 ft, add 15% to the size of motor suitable for the extra conveyor length.

Horsepower is converted into torque by the formula:

$$\text{Torque, in.-lb} = 63{,}000 \times \text{hp/rpm}$$

Manufacturers list the maximum torque for standard screw conveyors as in Table 2.

Capacity

The required capacity may be so large that some other type of conveyor is advisable. The screw conveyor is least costly, but is primarily for small

ENGINEERING DATA

Beginning this month is a department devoted to engineering data that plant engineers can use as a reference guide in their design and installation work. If you have a pet curve, chart or other data send it in. Rate of pay will be based on the engineering value of contributions, with a minimum of $15 for small items accepted.

TABLE 1 — MAXIMUM LUMP SIZES (in.) HANDLED BY SCREW CONVEYORS

Helix dia., in.	4	6	9	12	14	16	18	20	24
20 to 25% lumps	½	⅜	1½	2	2½	3	3	3½	3½
All lumps	¼	½	¾	1	1¼	1½	2	2	2½

TABLE 2 — MAXIMUM TORQUE FOR STANDARD SCREW CONVEYORS

Screw dia. in.	Inside dia. of tube spindle, in.	Maximum torque* capacity, in.-lb
6	1½	3,060
9	2	6,100
10	2	6,100
12	3	16,400
14	3	16,400
16	3	16,400
18	3½	16,400
20	4	25,600
24	4	25,600

*Maximum torque for standard construction with standard couplings and coupling bolts.

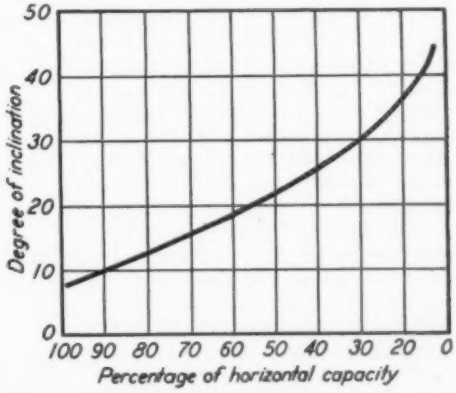


Fig 1 — Relation between rising incline and the capacity of standard-pitch screw conveyors

to moderate capacities. The largest standard size is 24 in. For this size, the maximum speed for sized coal is 60 rpm for which the capacity is about 7000 cu ft per hr, or about 175 tons per hr (from manufacturer's tables of capacities for various sizes and materials). But the more costly belt conveyor might be better, especially if the length is more than 100 ft, because only a fraction of the power is required to handle the same amount of coal.

Engineering Suggestions

If the conveyor is fed by gravity flow from an overhead bin, the section for the first few feet should be either of shorter pitch or smaller diameter, Fig. 2, so the rest of the conveyor will have a proper load percentage —the helix does not run full.

On long conveyors, it is advisable to have the drive at the far end so the spindle is in tension.

Where the conveyor has an open bottom trough to distribute the load along a bunker, its capacity is reduced because the material backs up against the helix. Therefore, an elevator discharging to it must have a similar reduced capacity. Farmers frequently use a screw conveyor called an "auger", which depends on the grain backing up around the helix to form the trough. After the bulk of the grain has been conveyed, the trough is removed.

For material that tends to set (as cement), allow a margin of power in the motor and reduction gearing for re-starting under load.

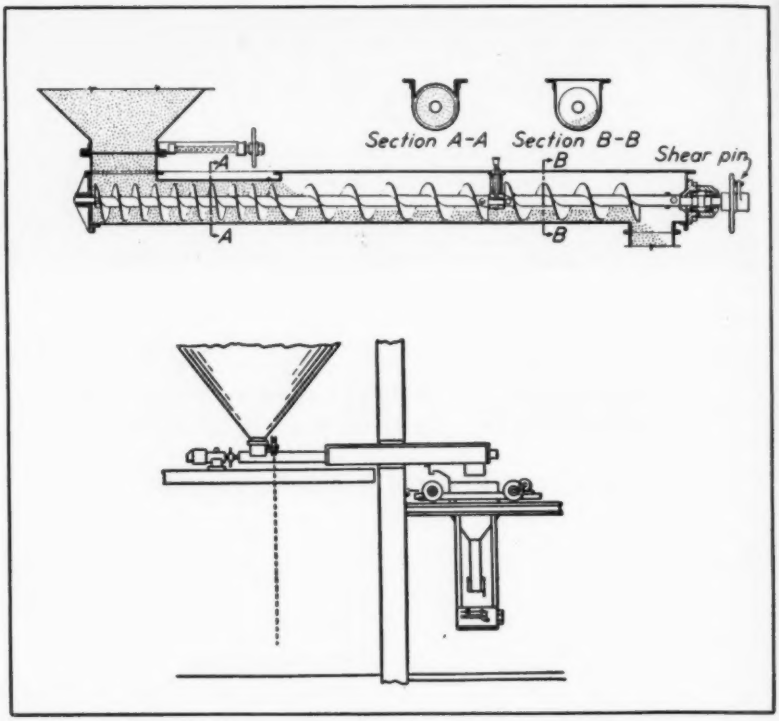


Fig 2 — Above: Feed control by section of smaller pitch helix at loading zone. Below: Feed control by section of smaller diameter screw delivering to a screw that feeds to a weigh larry. Loading of the larry is automatic

The screw conveyor properly applied is a very good machine, low in first cost and easily maintained. Replacements are low in cost and the trough is readily made dust tight by a cover plate. A special type, known as the Rotor Lift, is used with forced feed to handle materials vertically, and will be discussed in another article.

Bibliography: "Conveyors and Related Equipment" John Wiley & Sons, Inc. Booklets by conveyor manufacturers.

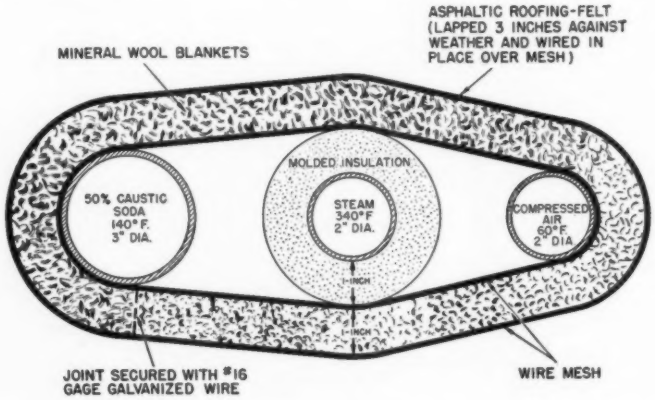
How to Prevent Overheating and Freezing With Insulation

●WHEN THE CONTENTS of an outdoor process line must be kept from freezing, a steam line can be run parallel to it, and the two pipes contained within one insulation covering. But when applying this technique, make sure the steam line does not overheat the process line.

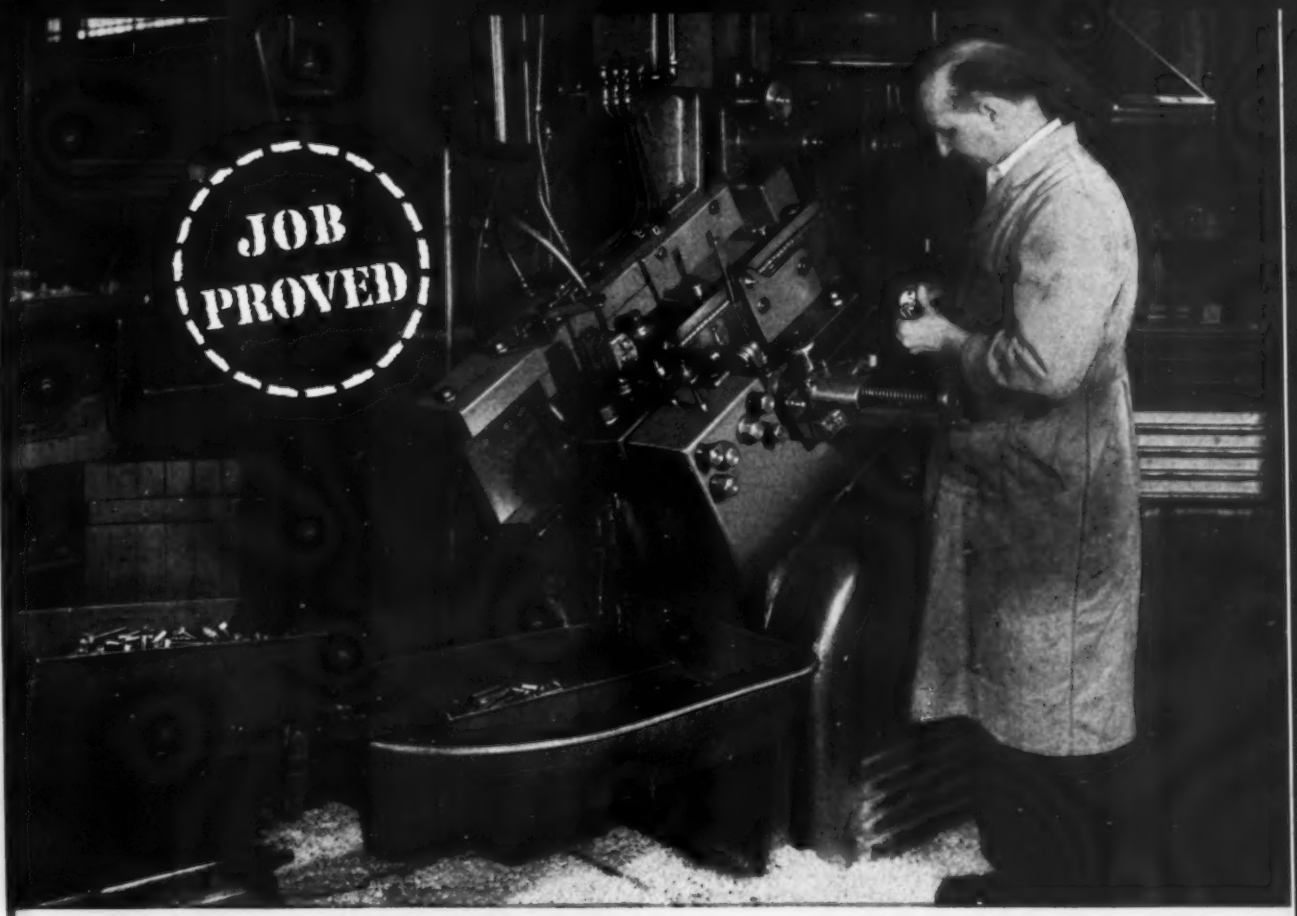
The method used in one installation to prevent both freezing and overheating of caustic-soda and compressed-air lines is shown in the cross-sectional drawing. One-inch molded sectional insulation was applied to the 2-in. steam pipe with the sections tightly butted together and held by metal bands.

After the steam pipe was insulated, mineral-wool blankets, sandwiched between facings of wire mesh, were cut and shaped around the three lines and held in place with 16-gage galvanized wire. Abutting ends and edges of the blankets were tightly laced together with 16-gage galvanized wire. To complete the installation, asphalt roofing felt was wrapped around the entire surface, lapped three inches against the weather, and bound on 6-in. centers with galvanized wires.

This method can be applied to outdoor piping systems in chemical, petroleum and manufacturing industries where continuous operation must be maintained under all weather conditions. *Courtesy of Stauffer Chemical Co. and Industrial Mineral Wool Institute.*


ASPHALTIC ROOFING-FELT (LAPPED 3 INCHES AGAINST WEATHER AND WIRED IN PLACE OVER MESH)
MINERAL WOOL BLANKETS
MOLDED INSULATION
50% CAUSTIC SODA 140° F. 3" DIA.
STEAM 340° F 2" DIA.
COMPRESSED AIR 60° F. 2" DIA
1-INCH
1-INCH
JOINT SECURED WITH #16 GAGE GALVANIZED WIRE
WIRE MESH

INSULATION-WITHIN-INSULATION ON PARALLEL OUTDOOR PIPE LINES



SUNTAC ENDS LUBRICATION HEADACHE

Keeps Plant in Full Operation and Reduces Oil Consumption 50%

Cold-rolling threads on cold-headed bolts is a tough operation, and a mighty big financial headache, if the thread-roller does not receive proper lubrication.

Such a condition developed in the plant of a well-known manufacturer of screw machine products. Oil ran out of bearings and would not adhere to the guides for the reciprocating die holder. On several occasions the main bearings overheated and seized up. In each instance four days' downtime resulted, costing a large amount for labor and 30 percent in bolt production. Furthermore, the oil loss became so excessive that maintenance crews actually had to put in extra work to keep floors clean and safe.

In his search for a solution to the problem, this manufacturer called in a Sun representative, who induced him to try Suntac Oil. In the 18 months which have elapsed, there have been no production losses attributable to inadequate lubrication, downtime has been eliminated, and cleanups have been reduced to a routine minimum. The consumption of oil has been cut in half. Savings on oil and maintenance have amounted to more than $3,000.

Suntac Oils are recommended for general lubrication in all machinery where retention of oil in bearings is a problem. These "Job Proved" products cling to the parts to be lubricated. For further information, call or write your nearest Sun Office.

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SUN PETROLEUM PRODUCTS
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Short Items

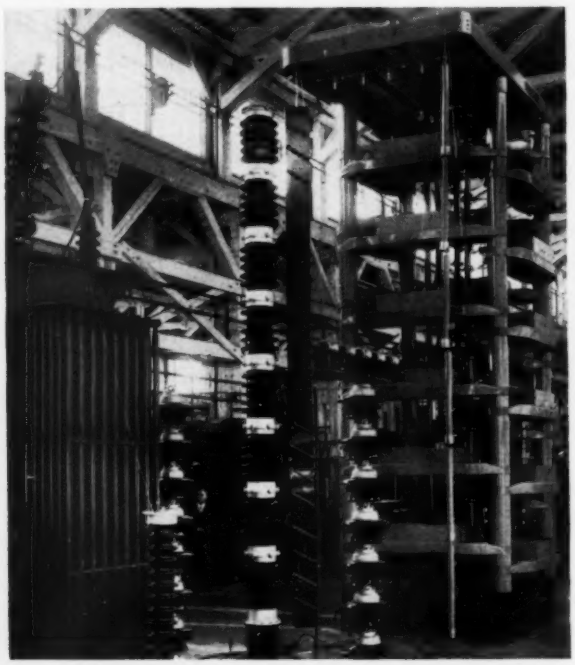
Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Lightning Generator Installed For Large Transformer Testing

The illustrated lightning generator of 2,400,000-v capacity has been installed at the Sunnyvale, Calif., works of the Westinghouse Electric Corp. This unit is believed to be the only electrical impulse testing machine of its size and type in a western manufacturing plant. The 25-ft high generator will be used not only for high-voltage quality control tests, but also for other tests specified by electric utility or industrial firms ordering large power transformers.

This surge generator forms part of a new $250,000 transformer test section at Sunnyvale. Equipment in this section includes many other pieces of test apparatus as well as a smaller surge generator used to test CSP distribution transformers.

The 2,400,000-v generator operates according to the "Marx principle" which involves charging 24 banks of capacitors in parallel with 100,000 v of electricity each and discharging them in series by flashing over the spark gap. Adjustable spheres on the spark gap permit use of any voltage desired up to the full 2,400,000 v. Timing and shape of the resulting electrical wave are recorded photographically by cathode ray oscillograph equipment in the control room. In operation, 440 v a-c is stepped up by special transformer to supply two 50,000-v d-c vacuum-tube rectifiers. Charging the surge generator requires from 20 to 30 sec. It can then be discharged at will by an operator in the control room.



Periscope Views Burning of Turbine Exhaust Gases

Water-cooled 12-ft periscope for looking into the fiery exhaust of a jet engine has been developed by G-E's Engineering and Consulting Laboratory. This quarter-ton steel cylinder permits engineers to watch the pattern of burning gases in the 2,500 F exhaust blast. One end of the periscope is placed 10 ft behind the jet engine being studied.

The periscope is jacketed in thick stainless steel, beneath which is a 45-gpm water-cooling system for carrying away terrific exhaust heat. A quartz window, both air-cooled and water-cooled, is so placed that engineers can look directly into the exhaust cone of the engine. The air-cooling system blows a stream of cold air over the quartz window, preventing the exhaust gases from reaching the window.

Image of the burning gases is transmitted through the tube to observers by means of a conventional optical system. On the viewer's end of the periscope are a 16-mm motion

picture camera, an eyepiece for an observer, and a large television-like screen which several persons may watch.

Gas Turbine-Electric Locomotive Starts Second Year of Test

The nation's first gas-turbine electric locomotive, a 4,500-hp unit that the General Electric Co. and American Locomotive Co. are testing on the Union Pacific, has returned to

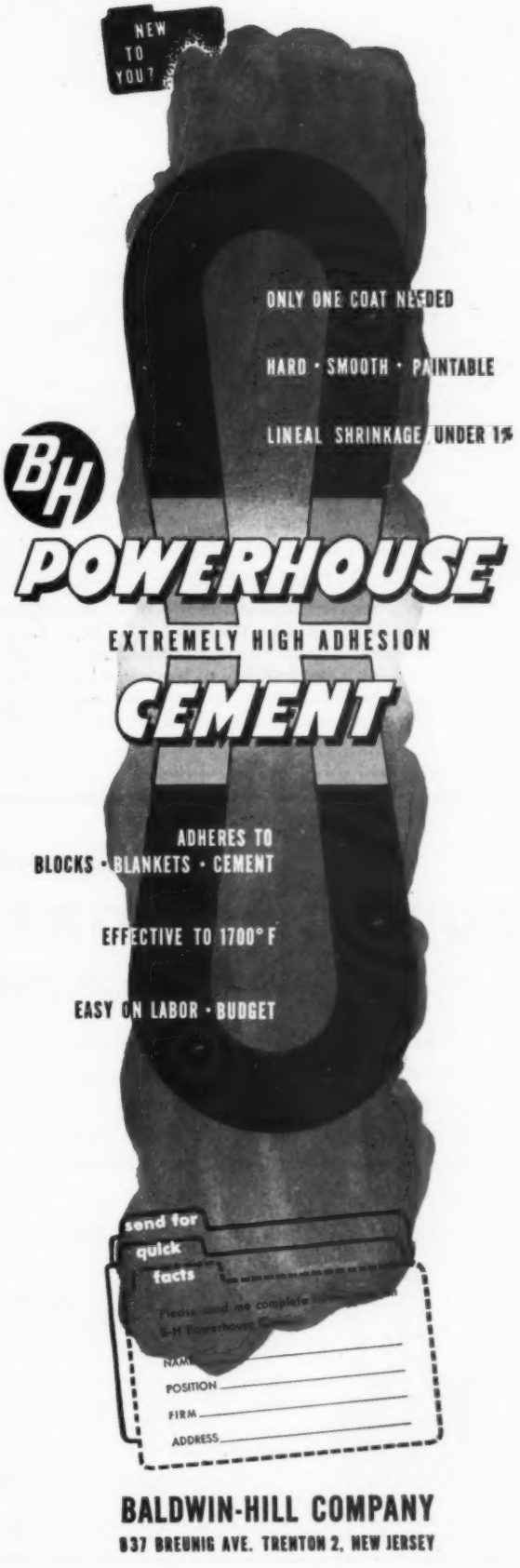
freight runs. It has just undergone a thorough shop inspection following completion of its first year of operation.

In summarizing the unit's first year on the rails, G. W. Wilson, manager of G-E's Locomotive and Car Equipment Div., declared that during this period the locomotive performed successfully under almost every conceivable operating condition. Wilson emphasized, however, that the developmental unit must undergo many more hours of rigid road tests before its future as a railroad prime mover can be determined.

Research and Development Laboratory Designed to Improve Textile Operations

United States Rubber Co. recently dedicated its $250,000 textile research and development laboratory at Winnsboro, S. C. Development activities will be coordinated closely with the product control laboratories of the company's various mills, with the general laboratories at Passaic, N. J., and with fundamental research conducted by such organizations as the New Orleans laboratory of the United States Department of Agriculture and the Textile Research Institute at Princeton, N. J.

Pilot-plant facilities to serve all mills have been installed. These facilities, which include equipment for spinning, twisting and weaving, are located in a large processing area designed for work on special yarn and fabric projects. A physical testing laboratory, chemical laboratory, machine shop, statistical department, technical library, conference room and various offices are also included.



Damaged Cable Insulation Traced to Soil Microbes

Living organisms, too small to be seen by the naked eye, are exacting a toll on natural and synthetic rubber insulated electric cables laid in soil. After laboratory study, John T. Blake and Donald W. Kitchen of the Simplex Wire and Cable Co., Cambridge, Mass., reported to the North Eastern District Meeting of the AIEE last month that the loss of insulation resistance in active soil was due neither to water absorption nor to the action of soil chemicals but to living micro-organisms.

Certain soil microbes consume natural-rubber hydrocarbon, leaving visible surface pitting, but there were no visible signs of attack on synthetic rubber insulation. In both cases, however, action of the microbes caused low insulation resistance.

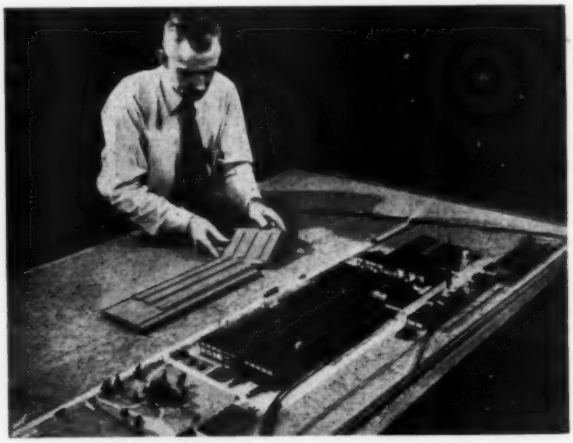
Damage to the natural rubber was apparent to the eye, but laboratory tests were necessary to show it in the synthetic rubber. The tests indicate that while the latter insulation was not eaten by the organisms, other material in the insulation was consumed, leading to electrical failure through lessening of insulation.

Goodyear Tire and Rubber Co. Plans $1,000,000 Plant Addition

One million dollar expansion and improvement program at Goodyear Tire and Rubber Company's St. Marys, Ohio, plant is scheduled to get under way immediately. Ground will be broken for a new building to house molded and extruded goods manufacture, warehousing and engineering services. This new addition is to be 170 ft wide and 660 ft long.

The structure is to be a one-story monitor type having raised roof portions to improve lighting and air circulation. It will be constructed of concrete blocks and steel. Steel contract was awarded to Burger Iron and Steel Co., Akron. The Clemmer Construction Co. was named general contractor.

In Goodyear's St. Marys plant, molded rubber parts are made to a wide range of specifications for all types of industrial applications. Most production is on a mass basis. The plant manufactures from 800 to 1,000 products monthly; parts include tiny hydraulic seals only 3/8 in. dia and weighing less than a gram, as well as mammoth dam seals 100 ft long and weighing more than 500 lb.



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with NICHOLSON STEAM TRAPS . . .

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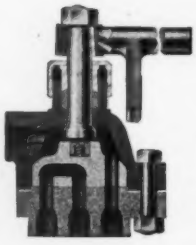
Send for Trap Catalog 250 or see Sweet's



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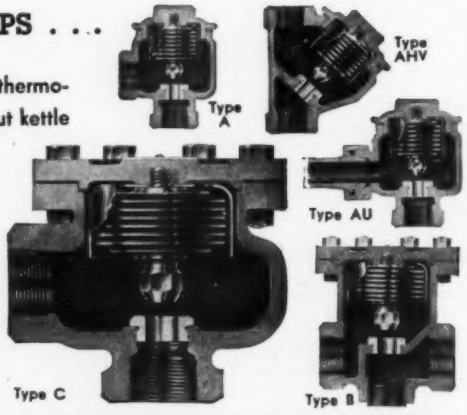

5 TYPES FOR EVERY PLANT APPLICATION—power, heat, process. Sizes 1/4" to 2"; any press. to 225 lbs. without changing or adjusting valve.

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Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

Boiler Feedwater Treatment Compound Will Be Made From Processed Cedar

Construction has been started by the Chemical Div. of the Portland Shingle Co. on a new plant to manufacture Borgana, a boiler treatment material obtained from waste products of shingle mills. The plant will be located in Portland, Ore., adjacent to the company's present facilities. It will

replace a pilot plant originally used to manufacture Borgana. When completed the new plant will have a 100-bbl daily production capacity.

From tests in the original pilot plant, more than $500 worth of chemicals will be removed from one ton of cedar, which formerly was burned at the mill as waste. Selected cedar woods are chemically treated and subjected to a leaching process that removes the solids. The remaining liquid is processed for uniform concentration and becomes the finished product. Through research and testing under the most adverse conditions, it has been proved that the active organic elements in the product slowly penetrate and remove boiler scale.

Illinois Tech Starts Tests To Eliminate High-Frequency Machinery Vibration

Scientists at Illinois Institute of Technology have begun research aimed at decreasing the noise caused by transmission of high-frequency vibrations from reciprocating and rotating machinery. The basic process of restricting vibrations to the machinery with isolating mounts is known to engineers. The spread of vibrations throughout the housing structure has been effectively solved in most cases of normal frequency vibration (relatively few vibrations per sec).

However, present-day demands for accelerated performances have resulted in faster and more powerful engines, compressors, and other mechanical equipment. Resulting high frequencies of vibrations are beyond the range for which existing mounts were originally tested. Therefore, some types of commercial mounts are inadequate in high-frequency range.

To date, experiments conducted by Chester A. Arents, assistant dean of engineering, and Wilson P. Green, professor of mechanical engineering, have been confined to testing existing mounts. It is possible that from these tests an improved design may be developed for the interception of harmful and irritating high-frequency vibrations.

In measuring vibrations, the mounts are placed between

GENERAL
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RODA — High grade gas, by-product, steam and household stoker coal from Wise County, Virginia, on the Interstate Railroad.

DENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX — A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

GLENBROOK — The Premium Kentucky High Splint unmatched for domestic use. Produced in Harlan County, Kentucky, on the L. & N. Railroad.

COKE — Roda and Stonega from Wise County, Va.

CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

HAMPTON COAL — High volatile domestic, steam and by-product coal from Boone and Logan Counties, W. Va., on the Chesapeake & Ohio Ry.

CROZER — Genuine Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railway.

LYNCO — High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Virginian Ry.

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Hazle Brook—*Premium Lehigh*
Raven Run—*Premium Mahanoy*

Capable engineering personnel and the experience gained through long and varied marketing activity assure proper application of one of the above brands and effective servicing of any fuel requirement.

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a loading weight and an electro-magnetic driver that delivers regulated vibrations. Readings are taken by electronic measuring instrumenets. From these data, the scientists are able to establish a ratio between the vibrations of the driver and those transmitted through the mount. The entire arrangement is suspended by balances, counter-balances, and springs which prevent any foreign disturbances from entering the system.

Standard Industrial-Equipment Grays Have More Color Harmony

First unified efforts of industry to reduce the number of colors for industrial apparatus, machines and equipment are beginning to bear fruit as a result of unanimous agreement on four accurately defined grays as standard finishes. American Standards Association announces adoption of these standard grays following a consensus reached by 18 organizations and groups representing all classes of manufacturers and users of such equipment.

General acceptance of this new standard on "Gray Finishes for Industrial Apparatus and Equipment" (ASA Z55.1-1950) by individual manufacturers and purchasers of industrial equipment and machines is expected to reduce considerably the cost of finishes and finishing. Color guides are expected to eliminate haphazard choice of shades from the limitless possible shade variations.

Development of color standards stems from past trouble

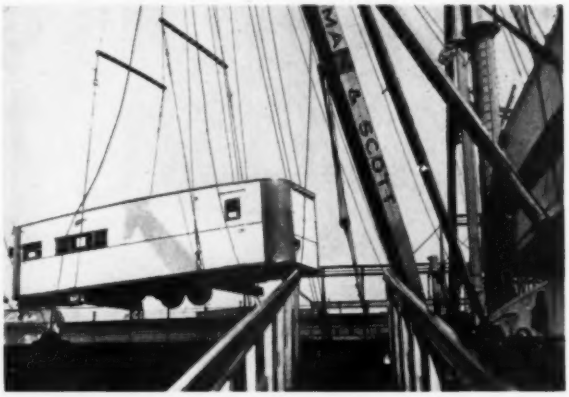
in color identification and lack of standard color finishes for industrial products. Where master colors had been used, variations grew out of differences in formulation and aging, variations in tolerance limits, and infrequent or no comparison with master colors. Use of color names or paint numbers also have obvious disadvantages. The need for standard colors became acute at the start of World War II as a result of extensive subcontracting. Attention focused on this need resulted in a study of grays.

Contrary to the popular conception of grays, they are not necessarily variations in proportions of black and white. They may be light or dark colors with low or weak chroma (less than 1.5). Actually light gray is a green, medium gray is a blue green, and medium dark and dark grays are blues under the more discerning "eye" of a spectrophotometer, which is the basic instrument for identifying color. Munsell notations are derived from measurements made with this instrument.

Munsell notations were adopted for identifying opaque coatings such as paint because basic color measurements made with a spectrophotometer are not suitable for general industrial use. These notations have been calibrated against basic measurements made with the spectrophotometer and have been codified by means of color samples for easy reference in the Munsell Book of Color, published by the Munsell Color Co.

Factory-On-Wheels, Comprised of 30 Trailers, Will Manufacture Oil Drums

The illustration shows a stainless steel restaurant trailer—manufactured by The Indian Trailer Corp.—being loaded for shipment to the 1950 Paris International Trade Fair.



It will be exhibited with seven other U. S. made units as part of a revolutionary new "factory-on-wheels" for the manufacture of steel oil drums and barrels. This "factory-on-wheels" is a complete traveling industrial community consisting of complete manufacturing facilities, plus offices, kitchen, housing and recreation trailers for the factory's employees. Electricity to run the plant will be furnished by a dynamo-equipped power truck.

After being exhibited at other Trade Fairs in Europe, the entire mobile factory and its staff of workers will set out for the world's oil fields where there are no existing manufacturing facilities for steel containers.

GOODYEAR FLYS NATIONAL SAFETY COUNCIL PENNANTS

National Safety Council pennants for outstanding safety records are flying today over all domestic plants of The Goodyear Tire and Rubber Co. They symbolize the award of a Distinguished Service to Safety plaque. This plaque was presented to Russ Young, Goodyear vice president (left), by Ned Dearborn, National Safety Council president (center); J. T. Kidney, Goodyear safety director looks on. The honor was paid Goodyear because of its outstanding 1949 record covering 40,000 employees for almost 73 million man-hours

Goodrich Laboratory Will Study Problems Related To Use of Chemicals and Plastics

Plans are under way for the construction of an applied research laboratory, which is the third unit in the multi-million dollar B. F. Goodrich Chemical Co. installation at Avon Lake, Ohio. A general chemicals plant and experimental station are already in operation. W. S. Richardson, president, said the new laboratory is a further step in the company's research and development program and will broaden and improve technical service and material evaluation facilities now located in Cleveland, Ohio.

The new one story building will cover 17,500 sq ft and have separate materials and processing laboratories, a compounding room, Banbury mixing room, controlled temperature test room, offices and conference rooms. The technical staff will have the most efficient electrical, chemical and mechanical testing apparatus for conducting general evaluation studies on thousands of products and materials.

Primary function of the new laboratory will be the continuation of sales service. Customers and prospective customers will be able to enlist confidential cooperation of the development staff in the analysis and solution of technical problems related to the use of chemicals, plastics and American rubbers.

Insulation Boxes Built Around Refrigeration Equipment

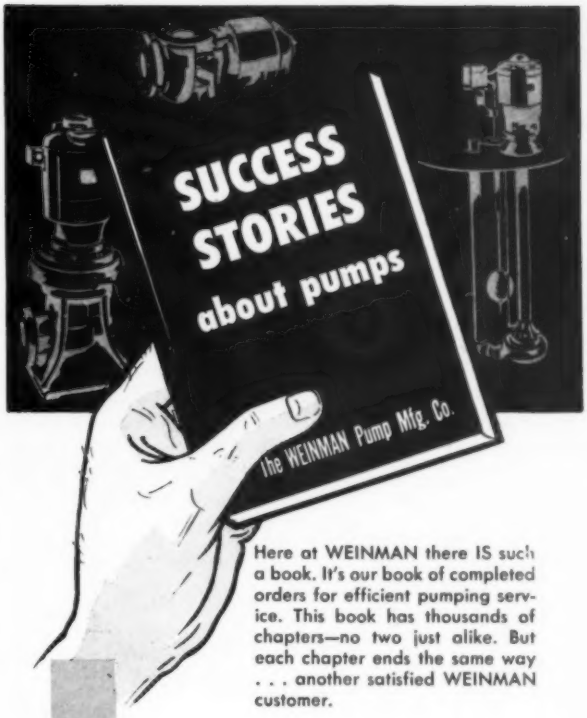
Unique insulated boxes built around the refrigeration units of a Midwestern engine research laboratory eliminate the necessity of applying insulation to the surfaces of individual odd-shaped cooling units. The boxes also facilitate

equipment maintenance, increase the thermal effectiveness of the insulation, and make initial application of the insulation easier and less expensive.

The refrigerator equipment, capable of making 20,000,000 lb of ice a day, lowers the ambient temperature of circulating air at 288,000 lb per hr to as low as minus 100 F. The primary refrigeration stage—cooling units, compressors, dehumidifiers, piping and fans—is enclosed in a rectangular insulated chamber. Operation is monitored on the outside of the insulated box at a single panel, which includes temperature and pressure-control meters.

Application of block insulation to a structure enclosing the cooling equipment is simpler and faster than applying insulation to the odd-shaped surfaces of the cooling units.

(Continued on page 147)



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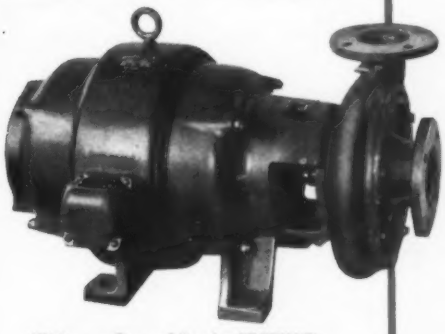
If you have the responsibility for efficient liquid handling at your plant, it will pay you to consult a WEINMAN representative. He will help you work out any pumping problem—application—installation—or replacement. Your problems can then be solved and another "success story" will be added to our book.

For a non-obligating consultation, just write, wire or phone WEINMAN Career Men in Pumps.



Weinman General Service UNIPUMP handles up to 1000 G.P.M., heads to 500 feet.

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MEETINGS and EXHIBITIONS

Highlights of comming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

Engineering College Research Council—Comprehensive survey of engineering research activities in the Pacific Northwest will be provided during the 1950 annual convention of the American Society for Engineering Education at the University of Washington, Seattle, June 19 to 23. Three sessions will be devoted to federal and industrial research activities of the region and their relation to the area's educational institutions.

Speakers will include: S. E. Schultz, chief engineer for Bonneville Power Administration; Samuel J. Hutchinson, assistant regional director of the Fish and Wild Life Service; Don Walters, director of the Inland Empire Research Council; H. K. Benson, director of research for the Laucks Co.; W. W. Moyer, director of research at Crown Zellerbach Corp.; Don Redfer, technical director of American - Marietta Corp.; S. E. Maddigan, director of the British Columbia Research Council; and Donald W. Finlay of the Seattle Div., Boeing Airplane Co.

Principal speaker at the annual dinner will be Dr. Gerald A. Rosselot, director of the State Engineering Experiment Station at the Georgia Institute of Technology.

Institute of Northwest Resources—Second Annual Meeting, June 19-30, Oregon State College, Corvallis, Ore. Prof. J. Granville Jenson is coordinator for the institute. The two week institute will feature some twenty outstanding authorities on Northwest regional resources development and utilization in daily seminar discussions on selected topics currently of urgent importance to the Northwest. Opportunity will be provided for teachers, business, civic and professional leaders to become better informed on the state of Northwest regional development and with the plans now being carried forward by existing agencies. Critical analyses for interpreting regional development propositions such as the CVA will be presented. Field trips for observation of resource utilization will form an outstanding part of the two weeks session.

Wisconsin Power Conference and Exposition—June 7, 8 and 9, Hotel Schroeder, Milwaukee, Wisconsin. Cosponsored by the Wisconsin State Association of the National Association of Power Engineers and the Associate Engineers and Supplymen of Wisconsin: Walter W. Roock, secretary, 3430 W. Forest Home Ave., Milwaukee 15, Wisconsin. Subjects to be covered will include: economic and operating comparisons of coal, oil and natural gas; boiler water conditioning; refractories; electricity; pumps; heating and ventilating; plant maintenance and plant safety.

MIT, Plastics Committee—Plastics and their mechanical properties as viewed from the standpoint of research, engineering, and architecture will be the subject of a three-day conference at the Massachusets Institute of Technology on June 20, 21, and 22, 1950.

Sponsored by the MIT Plastics Committee, the program will provide an opportunity for those interested in but not directly associated with plastics to hear and participate in discussions of their many properties and uses. Research workers in the field will report their findings for discussion by others engaged in research as well as by engineers involved in plastics applications.

Professor A. G. H. Dietz, department of Building Engineering and Construction, is chairman of the conference's sponsoring committee. Other faculty members on the committee include: Professor E. A. Hauser, chemical engineering; Professor W. M. Murray, mechanical engineering; Professor E. R. Schwartz, textile technology; and Professor W. S. Stockmayer, chemistry.

The schedule of papers to be given at the conference is as follews:

Tuesday, June 20, 1950:

The Theory of Visco-Elastic Behavior in High Polymers, by Turner Alfrey, Polytechnic Institute of Brooklyn.

Static and Dynamic Properties of Rubber-like Materials, by E. Guth, University of Notre Dame.

Reaction of Polymers and Mechanical Waves, by W. O. Baker, Bell Telephone Laboratories.

Mechanical Properties of Plastics at Ultrasonic Frequencies, by W. P. Mason, Bell Telephone Laboratories.

The Usefulness of Basic Mechanical Properties in the Evaluation of Plastic Materials, by R. Buchdahl and L. E. Nielsen, Monsanto Chemical Co.

Mechanical Properties of Linear Amorphous Polymers, by R. D. Andrews, Princeton University.

Wednesday, June 21, 1950:

Flow Markings in Polymetric Solids, by Waller George and George Irwin, Naval Research Laboratory.

Injection Molding of Polystyrene, by R. S. Spencer, Dow Chemical Co.

Complex Stressing of Polymers, by I. L. Hopkins, Bell Telephone Laboratories.

Origin and Interpretation of Fracture Markings in Plastic Materials, by J. A. Kies, Naval Research Laboratory.

Flow and Fracture Characteristics of Polymethyl Methacrylate, by W. J. Gailus, Massachusetts Institute of Technology.

Creep and Relaxation Properties of Polymethyl Methacrylate, by Steven Yurenka, Massachusetts Institute of Technology.

The Effect of Molecular Weight Distribution on the Stress-Strain Properties of Polymethyl Methacrylate, by Earl Patterson, Massachusetts Institute of Technology.

The Effect of Orientation of Molecules on the Mechanical Properties of Polystyrene, by R. G. Cheatham, Massachusetts Institute of Technology.

Thursday, June 22, 1950:

Mechanical Properties of Rigid Plastics, by Robert Burns, Bell Telephone Laboratories.

Evaluating Mechanical Properties of Polyethylene and Other Non-Rigid Plastics, by R. H. Carey, Bakelite Division, Union Carbide and Carbon Corp.

Plastics-based Laminates, by G. H. Clark, The Formica Co.

Engineering Adhesives, by F. M. Reinhart, National Bureau of Standards.

Protective and Decorative Industrial Finishes, by M. R. Euverard, Interchemical Corp.

Synthetic Textiles in Automobiles, by N. J. Rakas, National Automotive Fibers, Inc.

Films and Coated Fabrics, by L. Boor, Philadelphia Quartermaster Depot.

Resistance of Plastics to Various Service Conditions, by G. M. Kline, National Bureau of Standards.

Industrial Relations—Five intensive full-time conferences on specialized aspects of personnel administration and industrial relations will be conducted next month by the Industrial Relations Section, California Institute of Technology, Pasadena, Calif.

Conferences scheduled are: July 9 to 14—Re-examining a pension program; July 9 to 14—wage and salary administration; July 16 to 21—managerial development; July 16 to 21—re-examining insurance and other benefit programs (other than pensions); and July 23 to 28—communication between management and employees.

Each conference is designed for executives responsible for the development and administration of the program to be discussed. Attendance is limited in order to permit full discussion and exchange of experiences.

The conference leaders include: Lee Laird, manager, Benefits Div., Standard Oil Co. of Calif.; Russell L. Moberly, director, Industrial Management Institute, University of Wisconsin; Paul Pigors, associate professor of Industrial Relations, Massachusetts Institute of Technology; John W. Riegel, director, Bureau of Industrial Relations, University of Michigan; Leo Wolman professor of economics, Columbia University; and Robert D. Gray, director, Industrial Relations Section, California Institute of Technology.

MIT Industrial Waste Conference—Three-day New England Industrial Waste Conference on June 26, 27 and 28 will be a feature of the 1950 summer session at the MIT. Joint sponsors are the department of Civil and Sanitary Engineering, the New England Council, and the New England Sewage Works Association. Professors Rolf Eliassen and Clair N. Sawyer represent the MIT sanitary engineering laboratories on the committee in charge of the conference.

Professor Walter H. Gale, director of the MIT summer session, described the conference as part of a broad series of summer activities scheduled during 1950 to make the Institute's special facilities available to those in industry and technology who cannot participate in its regular program.

The Industrial Waste Conference, according to Professor Eliassen, will

be designed to bring together these three groups: (1) industrialists, representing management, chemical engineers, and sanitary engineers; (2) representatives of stream pollution and water control agencies, including federal, regional and state; and (3) research workers and consulting engineers concerned with industrial wastes and water supply problems.

General discussions of pollution abatement from the viewpoints of industry, control agencies, and municipalities will be featured. There will also be symposia on the water and waste problems of specific New England industries, including pulp and paper, wool scouring, cotton and wool dyeing and finishing, metallurgy and metal working, and leather tanning.

National Instrument Conference—Fifth National Instrument Conference and Exhibit will be held in the Memorial Auditorium, Buffalo, N. Y., September 18-22, 1950. It will include technical sessions of the following participating societies: The Instrument Society of America, American Institute of Physics, Industrial and Regulators Division of the ASME, Institute of Radio Engineers, Instruments and Measurements Committee of the AIEE, and National Telemetering Forum.

The instrument exhibit will occupy 15,500 sq ft and will include scientific and industrial instruments and devices for measurement, inspection, testing and automatic control.

National Power Show—The 49th annual National Power Show sponsored by the National Association of Power Engineers will be held in Hotel Jefferson, St. Louis, Mo., August 15-19, 1950. It will run in conjunction with the 67th NAPE annual convention. John C. Toohy, 176 W. Adams St., Chicago, is exhibit manager.

Features of the 1950 show will be an extensive industrial film program, and round table clinics at which each exhibitor may discuss his problems or ideas. Exhibits will include all types of equipment and accessories for steam and power generation; steam and electrical distribution; power transmission; heating and ventilating; refrigeration; air-conditioning and materials-handling.

Stoker Manufacturers' Association—The annual meeting of the stoker group will be held in Chicago at the LaSalle Hotel on Thursday, June 15. This is a change in the date originally scheduled for this meeting. However, original plans remain the same; that is, to hold a one-day business meeting with a separate technical conference. This conference will be held in the morning simultaneously with a closed executive session of manufacturer and associate members.

The afternoon will be devoted to a program featuring talks by sales and merchandising specialists and by representatives of allied industries. A general open forum on the industry's most pressing problems is being planned.

Other events include the annual banquet, meetings of the retiring and new board of directors, and meetings of special committees.

Inquiries concerning this meeting should be addressed to Marc G. Bluth, executive secretary, Stoker Manufacturers Association, 307 North Michigan Avenue, Chicago 1, Ill.

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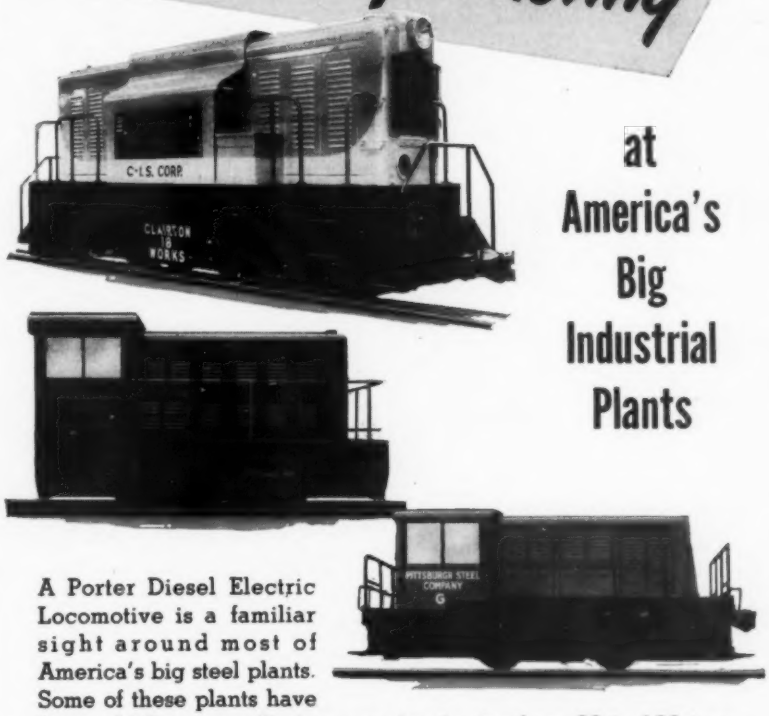
at America's Big Industrial Plants



A Porter Diesel Electric Locomotive is a familiar sight around most of America's big steel plants. Some of these plants have fleets of 15 or more Porters, ranging in size from 20 to 100 tons. Porter has been making industrial locomotives for eighty-four years. In those eight-four years, many large industrial concerns have become steady customers of the Porter Company, placing order after order for Porter Locomotives for replacements or additions to their fleet.

Porter engineers will be glad to survey your switching requirements and submit specifications for a standard or, if necessary, a special unit designed to your individual requirements. A Porter engineer can show you how to cut your switching costs.

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BOOK REVIEWS . . . . *Here are the latest books from the publishers lists reviewed for your convenience in selecting the ones that will meet your needs in a variety of engineering, plant equipment and related subjects*

Electrical Handbook

"Electrical Meterman's Handbook." Published by Edison Electric Institute, 420 Lexington Avenue, New York 17, New York. Illustrated. 640 pages. $4.90.

Sixth edition of the "Electrical Meterman's Handbook."—the first since 1940—has been considerably enlarged, rewritten and revised, and reflects the many changes in metering design and practice that have taken place since the appearance of the last edition.

This book represents more than two years work on the part of the Handbook Revision Committee of the Edison Electric Institute's Meter and Service Committee. The aim of the editors has been to make it a practical guide for experienced metermen, students, meter engineers and supervisory personnel.

Two new sections have been added: one dealing with special metering, and the other covering demand meters. There is an appendix containing material from the Fourth Edition of 1923. The latter includes essential meter data, diagrams for meter installation and testing, and numerous illustrations of meters, the meter shop and laboratory.

Electrical Standards

American Standard for Relays Associated with Electric Power Apparatus (C37.1-1950). Published by the American Standards Association, 70 East 45th Street, New York 17, N. Y. 12 pages. 60 cents.

Revision of the American Standard for Relays Associated with Electric Power Apparatus reflects progress since 1937 and, in general, includes new performance data such as fidelity of characteristics as affected by temperature, operating currents and voltages, wave form, and other factors; also, response to distance-type elements within certain limits of low voltage, high current and phase-angle deviations.

Limits of temperature rise are now based on an ambient temperature of 40 C instead of "above cooling air." The table of limits of temperature rise for coils no longer includes coils with Class 0 insulation, but such limits have been added for wire wound coils with Class H insulation. These are 130 C rise by the thermometer method of measurement, and 135 C rise by the resistance method. Permissable temperature rise of wire-wound coils with Class A insulation was slightly reduced. No changes were made in requirements of Classes B and C insulation.

Protective Relays

"Silent Sentinels, Westinghouse Protective Relays". Published by the Westinghouse Electric Corp., Meter Div., Newark, N. J. Illustrated, 236 pages. $3.50.

Latest edition devotes Part 1 to a comprehensive study of the application of protective relays to power systems with chapters on a-c apparatus, d-c systems, station busses, multiterminal lines and pilot relaying. The reader is led into the more detailed problems with a fundamental discussion of types of relays and their relation to breakers, the types and effects of faults on power systems, and a concise discussion of symmetrical components and their use in calculating short circuit currents and voltages.

Application of the relays to the various systems is discussed in detail. The text is well illustrated with readable circuit diagrams. Methods of obtaining maximum protection with minimum downtime by selective relaying are emphasized. It should be a valuable reference book not only for the design engineer, but also for the plant engineer interested in the available protective methods.

Part 2 covers various types and characteristics of relays and auxiliaries. It also supplies information on construction and circuit application. An appendix includes engineering data on cable characteristics, inductive and capacitive reactances, and coil burdens.

Equipment Rental Rates

"Compilation of Rental Rates for Construction Equipment." Published by Associated Equipment Distributors, 360 North Michigan Avenue, Chicago 1, Ill. $3.00.

This fifth edition is published for informational purposes only and is not intended to suggest or to influence rates or conditions of rental. It contains monthly, weekly, and daily rental rates on 266 major items of construction equipment. Information on which the compilation is based was secured from equipment distributors throughout the United States and represents over-all averages of rental rates actually charged by them. It is emphasized that the rates published in the compilation may differ from actual rates in many areas due to local practices and conditions.

Suspension Bridges

"Variable-Span Suspension Bridge," PB 99471. Published by the U. S. Department of Commerce. Order from Library of Congress, Photoduplication Service, Publication Board Project, Washington 25, D. C. Illustrated. 106 pages. Photostat copy, $13.75. Microfilm $4.50.

This book describes and illustrates a standardized bridge design suitable for temporary or permanent construction in beam spans of 20 and 24 ft, and pony truss spans of 40 to 200 ft; also, it can be used as a stiffened suspension bridge with a clear span of 160 to 640 ft. Developed by the U. S. Corps of Engineers, it is the result of a project undertaken to produce a variable-span design that could use standard parts in such structures as beam spans, pony truss spans, piers, towers and pile bents. The recommended design is a simple clean-cut structure with sufficient strength to carry 50-ton tanks.

With the addition of special parts to anchor cables to the trusses, a suspension bridge may be built as a self-anchored design. This includes suspension members of pre-stressed galvanized strands that are to be stocked in as few sizes as possible. One end of each strand is to be socketed in the shop, leaving the other end for field placement. A laminated wood floor is proposed for the bridge.

Turbines

"Steam and Gas Turbines," by B. G. A. Skrotzki and W. A. Vopat. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. Illustrated, 395 pages. $5.00.

Intended for operating engineers, maintenance men and others in the power field, this book is a complete but easily understood treatise on the construction of turbines. The fundamentals of steam power, the design of turbine parts, and turbine operating principles are discussed. General and detail construction of the various turbines, their uses and advantages are thoroughly considered. The latest designs of reheat and automatic extraction steam turbines, from small auxiliary drive to prime mover types, are included.

Power cycle auxiliaries such as condensers, traps and pumps are illustrated and handled in detail. Particular attention is given to governors. A complete section is devoted to turbine lubricants and lubrication.

Various types of gas turbines, as well as their characteristics and limitations, are also treated.

Testing Standards

"Testing by the National Bureau of Standards." National Bureau of Standards Circular C483 published by U. S. Government Printing office, Washington 25, D. C. 93 pages. 25 cents.

This book fully describes the Bureau's test policy, presents general information on testing, and lists fees for most of the test work that is done.

Testing and calibration activities stem from the Bureau's custody of the nation's basic physical standards. Accuracy and uniformity in measurements throughout the United States depend on these standards. Furthermore, Congress has authorized the Bureau to engage in testing work for the nation in those cases where devices or materials must be checked with these standards or where sufficient accuracy cannot be obtained elsewhere.

The National Bureau of Standards does not compete with qualified commercial testing laboratories, nor does it have the authorization, funds, or facilities to do general testing for the public. Fees listed include those for tests on electrical standards and instruments; standards of length, mass and time; pyrometers; fuels; radioactive standards; mechanical instruments; and optical instruments.

Hydraulic Conference Proceedings

"Proceedings Vol. III, 1949." Published by the National Conference on Industrial Hydraulics, Illinois Institute of Technology, Chicago 16, Ill. Illus-

trated. 218 pages. $3.50. Also available: "Proceedings Vol. II, 1948," $3.00; "Proceedings Vol. I, 1947," $3.00.

This book contains text of all papers presented at the fifth meeting of the National Conference on Industrial Hydraulics. Subjects are listed under six major topics: Recent Developments; Hydraulic Equipment Components; Design Considerations; Hydraulic Equipment Standards; Hydraulic Circuit Performances; and General. Some of the important topics under these headings are: "A Continuous Flow, Constant Pressure Hydraulic Power Transmission System," by Frank Berry, Cornith, Miss.; "Theory and Practice on Design of Hydraulic Seals," by R. O. Isenbarger, Chicago, Ill.; "Hydraulic Fluids—Petroleum and Synthetic," by R. O. Sharpe and C. W. Nichols, New York, N. Y.; and "What is Industrial Hydraulics," by R. Esch, Detroit, Mich.

Personnel Administration

"Problems in Personnel Administration," by Richard P. Calhoon. Published by Harper & Brothers, 51 East 33rd St., New York 16, N. Y. $5.50.

This unusually well-written book concerning techniques and practices of personnel administration should be of interest to administrators and industrial relations officials. Emphasis has been placed on problem analysis, problem handling and actual administration of personnel functions.

Major fields covered are: employment and training; developing organizational efficiency; working conditions, non-financial incentives and employee benefits; labor relations; and the personnel department. Many minor topics, usually glossed over, are treated at considerable length such as: work load and job assignment; administration policies and procedure; problems of interpreting legislation; personal administration and collective bargaining; methods of developing and effecting a personnel program; problems of safety administration; and women in personnel work.

Complex Numbers Table

National Bureau of Standards Applied Mathematics Series AMS8, "Table of Powers of Complex Numbers," by Herbert E. Salzer. Available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 44 pages. 25 cents.

Table of Powers of Complex Numbers has been published by the National Bureau of Standards to meet the needs of engineers, mathematicians and scientists who are working on problems in fields as diverse as a-c circuits, number theory, and exterior ballistics. The table is especially useful in the treatment of Taylor series involving complex variables. It is the first extensive table of powers of complex numbers ever published.

In this table, exact values of powers of complex numbers are given in Cartesian form for powers from 1 through 25, and for arguments with real and imaginary parts ranging separately 0 to 10 in unit steps. The table is arranged essentially in the order of magnitude of distances of the argument values from the origin in the complex plane.

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Simple installation that saves fittings, visual indication of operation, consistent operation at highest efficiency, quick start-ups of cold equipment and unequalled freedom from maintenance and repair costs, are features.

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NEWS . . . of men and companies

Flexible Tubing Corp.—Mr. Frederick K. Daggett, president, has announced the following personnel changes and appointments in line with the company's policy.

Wesley L. Guiles has now become a technical representative. Mr. Guiles makes available his field knowledge and engineering know-how resulting from nearly two years as the company development engineer.

W. L. Guiles

J. F. Chapin

Jack F. Chapin has been appointed development engineer, in charge of product and process engineering. A MIT graduate in chemical engineering, Jack Chapin's career there as an instructor was interrupted by World War II. He served with the U. S. Army in the Pacific theatre and was inactivated as Lieutenant Colonel.

Mr. Chapin from mid 1947 until his recent appointment to the Flexible Tubing staff operated as a chemical engineer in the research and development div. Pittsburgh Consolidated Coal Co.

Worthington Pump and Machinery Corp.—H. C. Ramsey, president, announced that Walther H. Feldmann who has resigned as president of the corporation's subsidiary company, Electric Machinery Mfg. Co. of Minneapolis, has been named vice president in charge of sales for Worthington. John J. Summersby will become vice president in charge of purchases; Frederick W. Thomas will become general manager of purchases; and Carleton Reynell, general representative, sales and purchasing departments.

Mr. Feldmann graduated from the Baltimore Polytechnic Institute in 1915, and from the Westinghouse student course in 1917. He joined Electric Machinery Mfg. Co. in 1922, after having served as a power sales engineer with Consolidated Gas, Electric Light and Power Co. of Baltimore. Advancing with E-M, he served successively as district manager, general sales manager, vice president and general manager until his election as president in 1944. A veteran of World War I, he served as an aviation pilot in the Navy. Mr. Feldmann will make his headquarters at Harrison, N. J.

Mr. Summersby joined the Cincinnati Works of Worthington in 1916 as a student engineer and has been with the corporation continuously, except when serving as a Lt. in World War I. He served as a salesman in the St. Paul office, then district sales manager, and in 1929 was appointed manager of Holyoke Works sales. Made assistant vice president in 1934, he became vice president in charge of sales in July, 1949. A graduate of Washington Univ. with a BS, Mr. Sommersby later received a ME degree from the same institution. He is a member of ASME and the Newcomen Society.

Frederick W. Thomas, new appointee as general manager of purchases, joined Worthington in 1936 as assistant general manager of purchases, after serving as general sales manager of mechanical power transmission equipment, John Waldron Corp. A graduate of Stevens Institute of Technology, he is a member of National Association of Purchasing Agents, Purchasing Agents Association of New York, Economic Club of New York, and the Railroad Club.

Carleton Reynell, formerly general manager of purchases and traffic, joined Worthington in 1930 as general purchasing agent and became manager of the purchases and traffic department in 1941. He is a member of the National Association of Purchasing Agents, ASME and the West Hudson Manufacturers Association. During World War I, Mr. Reynell served in the U. S. Corps of Engineers as a captain.

W. H. Feldmann

D. Cowger

Nordberg Mfg. Co.—Appointment of Dice Cowger as district manager of the Diesel Engine Department has been announced by R. W. Bayerlein, vice president, Heavy Machinery Div. Mr. Cowger had his headquarters at the Busch-Sulzer Brothers Diesel Engine Company Div. in St. Louis, Mo.

Prior to his joining Nordberg, Mr. Cowger was a member of the sales force of National Supply Co. which he joined in 1947. From 1942 to 1945 he represented Busch-Sulzer Co. in the New York office. From 1945 to 1947 he marketed and jobbed gasoline in St. Louis.

Following his schooling at Marietta College, he started work for the Pure Oil Co. in the construction of a refinery near Newark, Ohio, and was later transferred to the tank car sales department of that company. While with the Pure Oil Co. refinery he developed a special cut out of gasoline for the dry cleaning industry and for the rubber tire industry at Akron, Ohio.

Westinghouse Electric Corp.—Sturtevant Div. announces the realignment of its sales organization by the formation of two new departments: one to concentrate on sales of air conditioning products; and the other, air handling equipment. Purpose of the realignment of the organization is to provide more specialized service for customers in both air conditioning and air handling fields.

Newly-appointed manager of the air conditioning sales department is T. E. Smith, and manager of the air handling sales department is Phillip Cohen. Both departments will be under the supervision of J. C. Thompson, general sales manager.

Assisting Mr. Smith in the air conditioning sales department will be: E. M. Powell, self-contained product manager; H. R. Sewell, field-assembled product manager; and H. A. Blair, service manager. Newly-named air conditioning district managers are: northeast, W. B. Cott, New York City; southeast, W. L. Hunken, Atlanta; northwest, T. J. Mullen, Jr., Chicago; southwest, R. L. Sherrill, Jr., Dallas; and Pacific Coast, F. W. Jordan, San Francisco.

In directing the air handling activities, Mr. Cohen will be assisted by these product managers: H. M. Fisher, general purpose fans; J. E. McDonald, heavy duty fans; W. C. Goodwin, heat transfer products; and W. W. Martin, service section. Air handling field sales will be managed by; eastern district, Alexander Martin, New York; midwestern, E. N. Foss, II, Chicago, and Pacific Coast, R. W. Sigmund, San Francisco.

In keeping with the changes in the sales organization, Sturtevant's engineering department has been separated into two divisions: the air conditioning division to be directed by J. L. Ditzler, and the air handling division to be headed by H. E. Morton.

Diamond Power Specialty Corp.—Mr. William J. Fitzburgh has been elected executive vice president of this company. For the last five years he served as assistant to the president and chief engineer. Mr. Fitzburgh joined the Diamond organization in 1929 as a sales engineer in the New York offices. Eight years later he moved to Detroit as chief engineer, which position he held for seven years. Prior to joining Diamond, he worked for five years as sales engineer and radio specialist for GE. Mr. Fitzburgh received his ME degree from Stevens Institute of Technology in 1924.

W. J. Fitzburgh

W. F. Cantieri

Mr. W. F. Cantieri has been appointed chief engineer. In that capac-

ity he will have charge of the research, development, drafting, standards and engineering order departments; he will also handle patents. Mr. Cantieri graduated from the Virginia Polytechnic Institute in 1935 with the degree of BSME, and after a year of post-graduate work he received an MS degree in power plant engineering. Following diversified industrial and public utility experience, he served in the U. S. Navy during the war. Mr. Cantieri was chief engineer of the Chapman Chemical Co. for two years prior to May 1949 when he joined the research department of Diamond as materials application engineer.

ITE Circuit Breaker Co.—William Deans, chief engineer of the ITE Circuit Breaker Co., has been elected vice president in charge of engineering. He will be responsible for origination of the company's major engineering policies and coordination of all engineering matters among the company's various divisions and subsidiaries.

Gus E. Heberlein, who has been chief engineer of ITE's subsidiary, Railway & Industrial Engineering Co., has been appointed manager of the switchgear division of the parent company. Mr.

W. Deans

G. E. Heberlien

Heberlein will have charge of sales, engineering, manufacturing and associated services for large air circuit breakers and switchgear.

Mr. Deans has served as ITE's chief engineer since 1933. He is a Fellow of the AIEE and has made many contributions to the development of electrical switchgear, protective and control devices. A graduate of Cornell University, he was an instructor in electrical engineering there for three years before World War I. During that war he was a member of Thomas A. Edison's research staff. From 1918 until 1933 he was associated with the Sundh Electric Co., as chief engineer.

Mr. Herbelein has been chief engineer of R&IE since 1941. Prior to that time he was sales manager of the switchgear devices section of Westinghouse Corp. Before that he was a development engineer in the Westinghouse switchgear div. He is a graduate of Washington State College.

Kewanee Boiler Corp.—At a meeting of the board of directors W. B. Russell was elected president to fill the vacancy created by the death of R. B. Dickson. Mr. Russell also was elected a director.

After graduating from the Univ. of Illinois with a BS in ME, Mr. Russell took a position with Heggie-Simplex Boiler Co. He left that firm to join Kewanee July 1, 1933, as time study engineer, and later moved into the sales department in 1934. On March 24, 1938, he became assistant to the president

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and on February 5, 1945, he was elected vice president.

E. M. Palmer has been elected vice president. A graduate of Simpson College, he came to Kewanee November 15, 1926, and worked in the bookkeeping department. On January 16, 1931, he was transferred to Government sales which he later headed as manager. Mr. Palmer was advanced progressively to assistant general manager of sales and vice president general manager sales. Mr. Palmer is an associate of ASH&VE and a director of the Steel Boiler Institute, Inc.

Dearborn Chemical Co.—Announcement has been made of the addition of twelve new representatives to this company's sales and service staff. These men recently completed an intensive seven week training course conducted in Dearborn's Chicago offices and laboratories, and have been assigned to territories as indicated:

T. Armstrong, West Texas and New Mexico with headquarters in Amarillo; R. W. Bartlett, New England with headquarters in Boston; C. P. Blakeley, New Jersey with headquarters in New York City; T. Bull, Northern California with headquarters in San Francisco; J. W. Fisher, Eastern Ohio with headquarters in Cleveland; R. E. Johnson, Northern part of the city of Chicago; W. J. Mercier, Southern Wisconsin with headquarters in Milwaukee; R. T. Moran, part of Michigan with headquarters in Kalamazoo; D. E. Pedginse, Northern Indiana with headquarters in South Bend; and H. O. Scott, Central Ohio with headquarters in Dayton.

Two men also have been added to Dearborn's technical department in the Chicago office. V. P. Nobile will assist E. M. Welch, manager of Dearborn's industrial water treatment department and K. W. Franks will assist J. F. Wilkes, technical director of Dearborn's railroad department.

Cochrane Corp.—Ervin J. Bookout has been appointed eastern sales manager of this manufacturer of water conditioning equipment and steam power plant specialties. Mr. Bookout has been with Cochrane for many years as sales engineer in the Philadelphia territory and also as a member of the Cochrane laboratories.

E. J. Bookout

J. G. Pacan

Round Chain & Mfg. Co.—Appointment of John G. Pacan as district sales manager was announced recently by J. F. Ansink, general manager.

Mr. Pacan will be in charge of sales activities in the Wisconsin, Minnesota, Iowa, Nebraska and North and South Dakota territories. Prior to joining the Round organization, he was affiliated with Corbin Screw Div. of American Hardware Corp. for 34 years. For 18 years, he served as office manager and during the past 16 years was active in a sales executive capacity.

Minneapolis-Honeywell Regulator Co.—Douglas M. Considine has been appointed manager of the market extension division, general sales, of the Brown Instruments Div. Mr. Considine's appointment was announced by L. Morton Morley vice-president and general sales manager of this division. His new duties will include direction of advertising and technical and trade editorial activities. He also will continue as technical editor of "Instrumentation." A graduate of Case Institute of Technology he holds a BS in chemical engineering. He has been with the company since 1941.

Electric Machinery Mfg Co.—At a special meeting of the board of directors Richard H. Olson, formerly vice president in charge of sales, was elected president, succeeding Walther H. Feldmann who resigned to assume the office of vice president in charge of sales of Worthington Pump and Machinery Corp. The Electrical Machinery Mfg. Co. will continue to operate as a wholly owned subsidiary of Worthington Pump and Machinery Corp.

R. H. Olson

A. H. Brodie

Tube Turns, Inc.—John G. Seiler, executive vice president and general sales manager of Tube Turns of Canada Ltd., has announced the appointment of Arthur H. Brodie as district manager.

Mr. Brodie's headquarters will be at the company's plant in Chatham, Ontario. Born in Montreal, Mr. Brodie attended the Montreal Technical School and during World War II he served in the Canadian Army, first in the Ordnance Corps, then with the 48th Highlanders. He was associated with the International Equipment Co., Toronto, before joining Tube Turns of Canada.

Acheson Colloids Corp.—Howard A. Acheson, president, has announced the opening of headquarters of the Dispersed Pigments Div. at 420 Lexington Ave., New York. This is a separate office from the Graphite Div. New York office at 50 Church St.

Founded by Dr. Edward G. Acheson, the company has specialized for many years in the colloidal dispersion of solids in liquid carriers. Best known among these products have been the colloidal graphite dispersions in various forms sold under the trade name "dag" colloidal graphite.

New department headquarters and staff is headed by George Houston, recently appointed technical sales representative of the Dispersed Pigments Div. He will act as technical liaison between the factory and the field.

Wagner Electric Corp.—The southern portion of the sales territory served by the St. Louis electrical div. branch has been set up as a separate unit, with headquarters in Memphis and a sales office in New Orleans. Mr. A. C. Allen will remain at Memphis as branch manager of the newly established territory.

Remaining territory, with a main branch in St. Louis and a sub-branch in Indianapolis, will be under the direction of Mr. J. J. Scheid, who succeeds Mr. H. N. Felton as manager of the St. Louis branch. Mr. Felton was recently elected vice-president in charge of sales.

A. C. Allen

J. J. Schied

Object of this division is to provide the best possible service to buyers in all parts of the areas affected.

Borg-Warner Corp.—Roy C. Ingersoll, previously vice president, was elected president to succeed C. S. Davis, president for the past 21 years. Mr. Davis was elected to the newly created office of chairman of the board. G. A. Shallberg, previously executive vice president, was named chairman of the executive committee. Mr. Ingersoll, in addition to his duties as president, will assume the duties formerly assigned to the office of executive vice president.

Mr. Ingersoll has participated as a member of the executive committee and the board of directors in every phase of Borg-Warner's diversified operation. In addition, he has long been an outstanding figure in the steel and farm implement industries and active in state and national businessmen's associations. He has been vice president of the United States Chamber of Commerce for many years, is a director and member of the executive committee of the Rock Island Railroad, and is a past president of the Illinois Chamber of Commerce. He was graduated from Knox College in 1908.

As president of the Ingersoll, Franklin and Calumet Steel Div. of Borg-Warner, Mr. Ingersoll has been the operating head of five plants and mills in Chicago (West Pullman), Chicago Heights, Ill., New Castle, Ind., Kalamazoo, Mich., and Franklin, Pa. Under Mr. Ingersoll's direct supervision, the steel divisions of Borg-Warner have attracted industry-wide attention by accomplishing notable improvements in the production and heat-treating of steel.

Ray P. Johnson has been appointed administrative assistant to Roy C. Ingersoll. Mr. Johnson also is a member of the board of directors and first vice president of Morse Chain Co., one of the corporation's divisions with plants in Detroit, Ithaca, N. Y., and England.

Mr. Johnson joined the company in 1929. He has served in executive posts in the Borg-Warner Service Parts Co., Chicago, and as manager of the Washington office. During the war years he

was a Major in the Wheeled Vehicle Div. of the Office of the Chief of Ordnance in Detroit, maintaining constant contact with the automotive industry. Prior to his present appointment, Mr. Johnson served for several months as administrative assistant to the executive vice president.

Edward Valves, Inc.—Physical, chemical and metallurgical laboratories, formally opened less than a year ago, are being increased nearly fifty percent. Ground has already been broken for the construction of a new unit. This new addition will house special mechanical testing equipment for Edward and Nordstrom valves. The building—constructed on three levels—will facilitate operation of equipment to duplicate actual service conditions in steam power plants, petroleum and chemical fields.

Essentially all the new expansion will be devoted to testing valves and piping under fluid flow. Test boilers, compressors, pumps and other equipment will permit the utilization of gases and liquids at pressures up to 5,000 psi and temperatures up to 1,500 F.

Development of the research department into one of the largest in the United States for a manufacturing company of comparable size, has been under the direction of W. F. Crawford, Edward president, and L. H. Carr, director of research.

Graver Tank & Mfg. Co.—Graver Water Conditioning Co. Div. have announced the appointment of Tom Charbonneau as Florida representative.

Mr. Charbonneau has had extensive experience in this work. Following engineering courses in the Universities of Connecticut and Pennsylvania and special courses on water conditioning at the University of Florida, he devoted his attention to water conditioning problems in the southeastern states. For many years he has been engaged in sales and supervising work on treatment of boiler feedwater, consulting work on waste recovery, municipal water plants. He is a member of the American Water Works Association. Mr. Charbonneau's headquarters will be Orlando, Fla.

Dearborn Chemical Co., Ltd.—William W. Jamieson was appointed vice president of industrial sales and Lewis C. Blackhall was appointed an assistant vice president at a board of directors meeting according to H. N. Potter, vice president and general manager.

Mr. Jamieson joined Dearborn in 1922, became a sales representative, and in 1946 was promoted to manager of industrial water-treatment sales. His current position includes supervision of the company's NO-OX-ID rust preventive sales as well.

Mr. Blackhall has been with Dearborn since 1937, served as sales manager, industrial NO-OX-ID department.

The Minnesota Mining & Manufacturing Co.—Clarence M. King, former assistant treasurer and assistant secretary, has been named treasurer according to a recent announcement. He will continue as assistant secretary. George H. Schoettly and Edwin H. Church are new assistant treasurers.

Mr. King joined the firm in 1926 as an accountant and was later appointed

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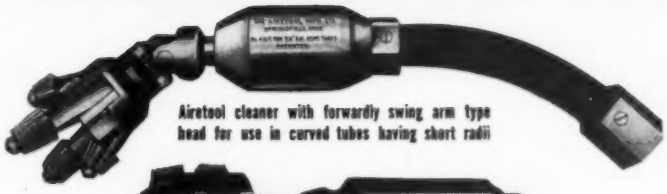

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auditor. He became assistant treasurer in 1939 and was elected assistant secretary in 1948. Mr. King has been the president and director of the Minnesota Insurance Buyers Association.

Mr. Schoettly first served as a bookkeeper for a year, then became assistant credit manager. He held that post for five years, and was credit manager for 20 years prior to his new promotion.

Mr. Church was controller of the Inland Rubber Corp. before joining 3M in 1949, and was auditor of disbursements before assuming the post of assistant treasurer. Inland is a former subsidiary of Minnesota Mining & Manufacturing Co.

Combustion Engineering — Superheater, Inc.—H. G. Ebdon and William P. E. Ainsworth have been elected vice presidents.

Mr. Ebdon joined CE in 1917 and since 1925 has served successively as manager of the proposition department; sales engineer, New York district office; and assistant general sales manager. In 1941 he was appointed general sales manager of boilers and related equipment. He will continue in the latter capacity, working in association with

H. G. Ebdon

W. P. E. Ainsworth

Donald S. Walker, vice president and director of sales.

Mr. Ainsworth has been associated with CE since 1921. Starting as a service engineer he later became manager of the service and erection department. In 1939 he was appointed general purchasing agent and in 1942 was also made production manager. As a vice president he will continue in charge of purchasing and production for the company's six American manufacturing plants.

Babcock & Wilcox Tube Co.—The appointment of John A. Menster as assistant manager of sales for the Welded Tube Div. has been announced by L. E. Jeanneret, manager of sales.

Mr. Menster is a native of Louisville, Ohio, and is a graduate of Ohio Univ. He has been with the company since 1943, starting in the general sales office and serving as manager of the office from 1944 until 1947. Since that time he has been assigned to special projects and recently has been actively engaged in sales development.

Mr. Menster will continue to make his headquarters in the general sales office at Alliance.

Hagan Corp.—Gordon S. Schuhmacher has been appointed district manager in Los Angeles to succeed R. L. Sullivan who resigned, according to D. J. Erikson, president. Mr. Schuhmacher will be assisted by Joseph R. Shafer.

Mr. Schuhmacher joined the company on July 25, 1942, for service in the Los Angeles territory. Prior to this date he was associated with Consolidated Steel Corp. He holds the BS in engineering from the Univ. of Kansas and is registered in the State of California as a professional engineer in

G. S. Schuhmacher

J. R. Shafer

chemical engineering and also in petroleum engineering.

Mr. Schafer joined the organization on December 1, 1941, as a service engineer. A graduate of the California Maritime Academy, with the BS in ME he was granted military leave of absence in October, 1942, and served three years in the United States Navy before returning to his engineering work at Hagan. He is a member of ASME.

General Electric Co.—Paul M. Deal has been appointed administrative assistant of Fractional Horsepower Motor Div. according to M. E. Lord, div. manager. Mr. Deal, 1938 graduate of Indiana Univ. came to GE as a student on the business training course. He was transferred to the accounting section of the Fort Wayne works and served as cost analyst in the Transformer Div. then as supervisor of cost and payroll at Decatur and Kokomo, and as plant accountant at Tiffin. In 1949 Mr. Deal was named assistant to the div. accountant, FHP Motor Div. and then supervisor of costs for the divisions, the position he held at the time of his present appointment. He is a member of the National Association of Cost Accountants.

Robert B. Moore has been appointed manager of the Mining Div. of the Industrial Engineering Div., it was announced recently by J. D. Wright, div. manager. Mr. Moore will succeed R. S. Sage, who plans to retire later this year.

Originally from Greenville, Mo., Mr. Moore graduated from Vanderbilt Univ. in 1940 with a degree in EE. After graduation, he joined GE spending initial assignments in Cleveland and Toledo offices and later becoming a student engineer on the Test Course. In 1943 he was transferred to the Commercial General Department in student placement work. Mr. Moore joined the Industrial Engineering Div. in 1944, where he worked in industrial application engineering for the textile, paper and lumber industries and in 1948 was transferred to the Mining Div.

Gordon C. Harvey has been appointed div. engineer of the Ballast Engineering Div. according to E. J. Thomas, manager of engineering, Specialty Transformer and Ballast Div. Mr. Harvey graduated from Ohio State Univ. in 1931 and joined GE the same year. In 1936 he was assigned to the engineering section of the Fractional Horsepower Motor Div. at Fort Wayne. He was transferred to the Decatur plant in 1945 and returned to Fort Wayne two years later to become assistant section engineer of the Ballast Engineering Div. He retained that position until his present appointment.

C. E. Burke has been named manager of sales of the company's Specialty Transformer and Ballast Div. at Fort Wayne, Ind., according to an announcement by W. C. Wichman, div. manager.

Mr. Burke held the position of manager of the Distribution Transformer Sales Div. for the Transformer and Allied Product Div. since 1945. Prior to that assignment, he served in a number of engineering and sales assignments both in district sales organization and in general office. During World War II he was associated with the National Advisory Committee for Aeronautics.

Acheson Colloids Corp.—Carl J. Parsch has been appointed advertising manager according to an announcement by M. W. Reynolds, vice president.

Mr. Parsch comes to his new position from the advertising agency of Simons-Michelson in Detroit. He was also with Davison Bros., Detroit. Much of the new advertising manager's time will be devoted to market research and sales promotion.

Hyster Co.—Two new district sales managers have been announced by C. H. Collier, Jr., head of the eastern div.

W. M. Costley will be in charge of a territory comprising Minnesota, Wisconsin, northern Illinois, Iowa, eastern Nebraska, North and South Dakota, and eastern Montana. Formerly with the Clark Equipment Co. as regional sales supervisor in the Chicago area for approximately five years, Mr. Costley also was in sales management for Chevrolet Motor Div. of the General Motors Corp. and Maytag Co.

Dan Stearns will handle sales in Pennsylvania, New Jersey, Virginia, West Virginia and the District of Columbia. Previously associated with the Clark Equipment Co. both as a dealer in the Chicago area and as a sales engineer for 5½ years, Mr. Stearns operated a

W. M. Costley

D. Stearns

wholesale lumber business in Michigan. For five years he was a district sales manager for the Firestone Tire and Rubber Co. His educational background includes study of mechanical engineering at the University of Illinois.

Timken Roller Bearing Co.—J. R. Comber, former manager of the Sales Order Div. has been named to head the Canton office of the Automotive Div. and handle special sales administration assignments. E. H. Hughes, systems department manager, was appointed manager of the Sales Order Div.

Mr. Comber has been with the com-

pany since 1913, when he started as a clerk and later worked in the cost, payroll and production departments until 1918 when he was placed in charge of the Sales Order Div.

Mr. Hughes came to Timken in 1938 following his graduation from Miami University at Oxford, Ohio. Starting in general accounting department, Mr. Hughes moved to the credit department, then to sales order and has been for the past several years head of the systems department. He has attended McKinley Law School and also continued studies in accounting and business administration. Associated with Mr. Hughes in the Sales Order Div. are T. J. Wayne, manager automotive orders, H. P. Dickerhoff, manager industrial orders and J. L. Brown, manager bearing order control.

Hunt-Spiller Mfg. Corp.—The nation's second oldest producer of iron castings is observing its 140th anniversary. Established in 1810 by Cyrus Alger, the foundry became one of America's leading ordnance producers before it began manufacture of marine, railroad, and industrial castings in the late '70's. By 1930, thirty-eight years after its reorganization as Hunt-Spiller, the South Boston works had iron in service on practically all the country's railroads and on ships throughout the world.

Diesel castings production was started on the basis of the foundry's experience with wear-resistant steam engine components. As the diesel volume grew, two large additions to plant were made to cast and machine liners, heads, piston rings, jackets, and other parts for marine and stationary service diesels.

Now in a ten-acre plant, not far from its original site, the one-time ordnance foundry is pouring both iron and steel for all forms of transportation and shaping an endless variety of castings for industrial use.

Leeds & Northrup Co.—In line with industrial growth of the Pacific Northwest, this manufacturer has opened a new sales and service office in Seattle to render prompt service to industry and to scientific and educational institutions in that area. Stratford B. Biddle, Jr., will be the manager, with Ira F. Omwake, Jr., as an assistant.

Mr. Biddle, an electrical engineering graduate of the California Institute of Technology, took advanced studies at University of California. He joined Leeds & Northrup as a field engineer in October, 1930.

Mr. Omwake attended Ohio State University, Warren College, Los Angeles, and University of Southern California. He joined Leeds & Northrup in May, 1936, and served successively as warehouseman, order clerk, service man, and field engineer.

Allis-Chalmers Mfg. Co.—R. D. Moody, manager of the San Francisco district since July, 1947, has been named manager of the Los Angeles district succeeding C. W. Schweers, who has been appointed manager of the company's New England region with headquarters in Boston.

Mr. Moody is succeeded as San Francisco manager by James A. Longley, Jr., who has been a sales representative

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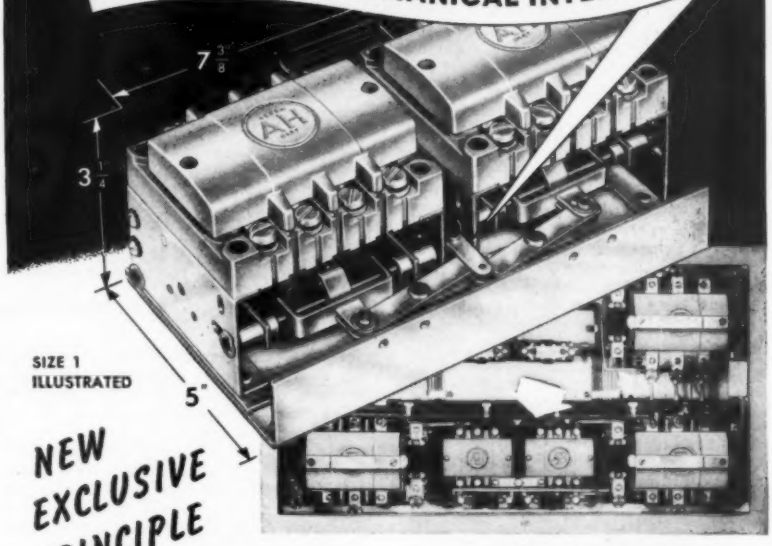

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in that office since March of 1946.

A graduate of the Colorado School of Mines, Mr. Moody was employed by the Mineral Engineering Co., Los Angeles, and the Riverside Cement Co., Riverside, Calif., before joining Allis-Chalmers in May, 1938. He was connected with the company's Knoxville and Chattanooga offices before transferring to San Francisco.

Mr. Longley is a Cornell Univ. graduate. He was associated with the Tennessee Electric Power Co., the Commonwealth & Southern Corp., and the Consumers Power Co., before entering Allis-Chalmers' San Francisco district office.

Elliott Co.—Mr. F. W. Dohring, vice president of sales, has announced the appointment of C. Porter Packard as sales manager of the Crocker-Wheeler Div. Mr. Packard has a background of 24 years' experience in electrical application engineering that included 17 years as a sales engineer for the New York industrial div. of Westinghouse. He has been Boston district manager for Crocker-Wheeler for the past three years.

C. P. Packard

H. J. Bordelon

Fluor Corp., Ltd. — Promotion .of Harold J. Bordelon to the post of advertising supervisor has just been announced. He succeeds Jack E. McKay, who has assumed the duties of sales engineer in Fluor's Houston sales office.

Mr. Bordelon has been associated with the company for the past eight years and was formerly assistant advertising manager previously connected with Fluor-o-Scope, the company employee magazine. He is active in business and civic affairs in the Los Angeles area and has been publicity chairman for the CNGA for the past two years.

Raybestos-Manhattan, Inc.—J. F. D. Rohrbach, president, announced the relocation of its Department of Marketing and Merchandising to the corporation's executive headquarters, Passaic, N. J. This move effects a closer working arrangement with officials and a desirable expansion of activities under the continued supervision of Franklin A. Miller as director of Marketing and Merchandising and J. W. Brush, Jr. as assistant.

National Electric Products Corp.—Robert C. Bennett, Jr. has been made vice president and sales manager according to an announcement by W. C. Robinson, Jr., vice president in charge of sales. He has taken over the responsibilities of Harold J. Newton, who recently retired.

Mr. Bennett, a native of Chicago, became associated in 1942 with I. A. Bennett & Co.; exclusive sales agent in 15 mid-western states for National Electric's electrical roughing-in materials. He covered the southern Illinois-Iowa territory as a salesman until 1947. Mr. Bennett then returned to Chicago to become assistant general manager of the Bennett organization and in 1948, he became general manager.

During World War II, Mr. Bennett was an officer in the Navy. He is currently a member of the executive committee of the Illinois Chapter, International Association of Electrical Inspectors.

R. C. Bennett

D. M. Waterhouse

Speco, Inc.—Appointment of David M. Waterhouse as manager of railway, marine, bus, truck and transportation sales has been announced by J. O. Vinney, president.

Mr. Waterhouse will supervise all field operations through his New York sales office, operating as Waterhouse & Co., Inc. He also will maintain sales headquarters in Norfolk, Virginia, and Chicago.

Speco, Inc. manufactures a complete line of maintenance paints, including anti-rust paint; wood preservative; chemical resistant paint and high heat resistant paint. The company also produces many specially-compounded maintenance products.

Chiksan Co.—In order to further expand its services to customers throughout the east and to speed up deliveries in that area, this company has established a warehouse stock in the Federal Storage Building, in Newark, N. J. At the same time, the eastern headquarters are being transferred from 50 Church St., New York, to the Newark address.

The establishment of a warehouse stock in the east will enable Chiksan to handle orders and shipments promptly and will substantially reduce time in transit on all deliveries in this area. The Newark warehouse stock will also save time in making up shipments to our rapidly expanding export outlets.

R. T. Jones and L. J. Smith, sales engineers, and E. T. Landgraff, manager of the New York office, will move to the new quarters in Newark.

Westinghouse Electric Corp.—Herbert H. Rogge, a veteran of 28 years in the electrical industry in this country and abroad, recently was elected president and chief executive officer of the Canadian Westinghouse Co., Ltd. Harold A. Cooch, former president was elected chairman of the board to succeed John R. Read. Mr. Read is retiring after 50 years of service.

Mr. Rogge joined Westinghouse (U. S. A.) in Brooklyn, New York, in 1922 as supervisor of rates. Four years later he transferred to Westinghouse Electric International Co. His first assignment was that of special representative in the Philippines, with headquarters in Manila. After a year and a half he moved deeper into Far Eastern territory to open new offices for Westinghouse International at Soerabaya, Java, in Singapore, in the Straits Settlements, in the Federated Malay States, and finally at Bangkok, Siam. Subsequently, he traveled extensively for Westinghouse in Europe, Latin America and the Caribbean area.

He returned to New York headquarters of Westinghouse International in 1929 to manage several divisions of that company before becoming sales manager in charge of all foreign sales in 1936.

He was transferred back to the parent Westinghouse Electric Corp. at Pittsburgh headquarters in 1939 to head up a new agency and specialties division, which had been organized to coordinate manufacturing and sales of specialty products in both the consumer and industrial fields. In 1940, he was named manager of the Westinghouse office in Washington, D. C., and in 1944 was elected vice president and given responsibility for Westinghouse sales in the New England, Middle Atlantic and Eastern states. He also retained supervision over the Washington office, but moved his headquarters to New York, where he remained until elected executive vice president of Canadian Westinghouse.

Mr. Cooch joined Canadian Westinghouse in 1910, and after two years in the apprentice engineering course at Pittsburgh entered the company's Toronto sales office in 1912. He remained in Toronto until 1923, when he was transferred to the Hamilton office of Canadian Westinghouse. The next year he was appointed assistant to vice president and in 1938 became a vice president. He was named vice president in charge of sales in 1944, and elected a director in 1946 and president in 1949.

H. H. Rogge

C. Basile

Link-Belt Speeder Corp.—At a meeting of the board of directors, Columbus Basile was elected vice president for operations with headquarters at Cedar Rapids. All officers who served last year were re-elected; namely, D. W. Lehti, president; G. H. Olson, vice president; H. E. Kellogg, treasurer and secretary.

Mr. Basile comes to Link-Belt Speeder from the parent Link-Belt Co. Caldwell plant in Chicago where he had been shop superintendent since December, 1947. He entered the employ of the Link-Belt Pershing Road Chicago plant in 1928. In 1938 he became a division manager for Sears Roebuck & Co.

He returned to Link-Belt in 1941 and successfully served as foreman of the machine shop at Link-Belt Ordnance Co., Chicago, as head of time-study and methods at the Link-Belt plant in Philadelphia, and as superintendent of the Caldwell plant in Chicago.

Crane Co.—H. D. Gibson, branch manager at Norfolk, Va., has been promoted to manager of the Richmond branch, succeeding W. O. Brown who has been advanced to manager of the plumbing department, general office, Chicago, Ill.

Mr. Gibson has served the company in various capacities since 1930 when he started as a salesman in the Omaha branch. In 1943 he was transferred to the marine sales department, Chicago, and in 1944 appointed manager at Norfolk.

H. D. Gibson

OBITUARIES

Worthington Pump and Machinery Corp.—Francis I. Kemp, manager of the Vertical Turbine Pump Div., died suddenly according to a recent announcement.

Mr. Kemp joined the organization in 1913 as a salesman in the St. Louis district office. He became district manager, first of the Kansas City office in 1921, and then of the San Francisco office in 1929. In 1944, he assumed managership of Vertical Turbine Pump Div.

E. F. Houghton & Co.—The death of L. D. Holland, assistant to the president and a member of the board of directors, has been announced. He was 46, and had been connected with the company since 1927 as sales representative, western div. sales manager, manager of research sales and assistant general sales manager. Educated at Coe College, Iowa, he was married in 1926 and is survived by his widow and two daughters.

Allis-Chalmers Mfg. Co.—Irving H. Reynolds, 88, retired executive and nephew of the late Edwin Reynolds, world famous mechanical engineer, died recently in Milwaukee.

Irving Reynolds joined the old E. P. Allis Co., forerunner of Allis-Chalmers, in 1884. In 1886, Edwin and Irving Reynolds designed the first triple-expansion pumping engine of the inverted type. Its tests showed the highest efficiencies ever attained by a pumping engine and attracted engineering attention from all over the country.

In 1901, Mr. Reynolds was named assistant chief engineer and general superintendent and later became chief engineer. He resigned in 1903 to become vice president and general manager of the William Tod Co., Youngstown, O. Returning to Allis-Chalmers in 1912 as manager and chief engineer of the engine department, Mr. Reynolds held this post until his retirement January 1, 1935.

If you pipe it...there's a **Fairbanks valve** to control it

Here are two typical examples of the outstanding design, sound engineering and rugged construction that are built into every Fairbanks Valve. Years of experience in meeting all kinds of valve requirements for industry, have given Fairbanks Engineers a storehouse of knowledge in controlling the flow of water, steam, gas, oil, chemicals, etc. Consult them without obligation.

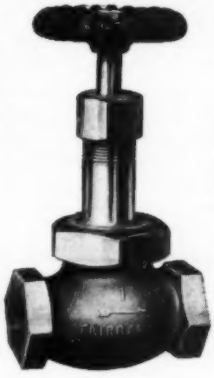

Fig. U-01
Renewable Composition Disc Globe Valve — 150 lb. S.W.P.

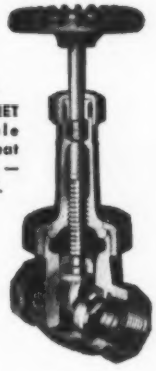

Fig. 0236
UNION BONNET — Renewable Nickel Alloy Seat Gate Valve — 200 lb. S.W.P.

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General Offices:
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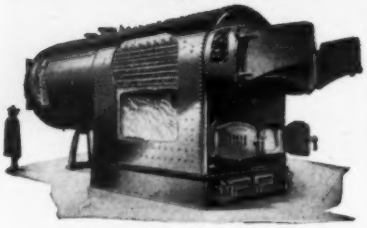

10 to 304 hp
100, 125 and 150 lbs wp

Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

Outstanding for extra years of dependable service in producing hi-pressure steam economically with Oil, Gas or Coal.

WRITE Department 96-D6 749
for 6" scale with pipe diameter markings

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ARMSTRONG BROS.
Better PIPE TOOLS

An easier, faster, better way to thread 1" to 2" pipe . . .
WITH POWER!

This light (26 lb.) compact Portable Power Pipe Threader, goes to the job — is *operated with a ½" portable electric drill.* 1 set of High Speed Steel Chasers does all sizes — just move indicator to 1", 1¼", 1½" or 2" marking. Clamp on pipe and apply drill to drive square. The rest is automatic. Operating on anti-friction bearings with automatic lead, it's a *fast,* easy way to get smooth, accurate threads.

Write for Catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5237 W. ARMSTRONG AVENUE • CHICAGO 30, ILL.

NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 16)

floating piston pins. The crankshaft is short, and is 5¼ in. in diameter at both crankpin and main bearings; this eliminates torsional vibration without the use of dampers.

Normal starting is by 250-psi air admitted to all cylinders in turn through a starting air distributor. Other methods of starting can also be furnished. The TS diesel is designed for mounting either on a concrete base or on welded-steel skids.

323—EXTERNAL SHUNTS AVAILABLE IN 3 STYLES

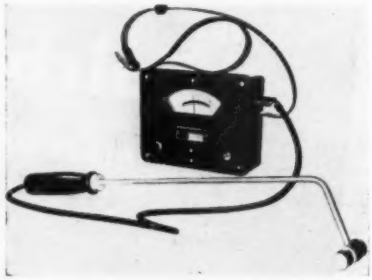
External shunts for electrical instruments are offered by the Cole Instrument Co. in three styles and in 38 capacities from 10 to 20,000 amp. Physical dimensions vary from 3¾ to 16⅜ in. in length. Capacities below 10 amp or above 20,000 amp are available on special order.

These switchboard shunts are special alloy strips fitted into terminal blocks. The ends of the block provide the means for connecting the shunt in the circuit. All lug blades are ¼ in. thick and spaced ¼ in. apart to receive ¼ in. bus bar. Shunts can be furnished adjusted for 50, 75 or 100 millivolt drop.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

324—PORTABLE INDICATOR DETERMINES TIN-LEAD RATIO

Portable direct reading indicator for determining the ratio of lead and tin content in solder has just been announced by the Wheelco Instruments



Co. Up to 7% tin content of lead alloys may be tested in a few seconds.

Application of this instrument by users of solder, such as manufacturers of tin cans, eliminates time consuming laboratory tests and results in considerable savings and improved product quality. The indicator meter comes equipped with shoulder strap and light weight sensing unit.

325—WATER FLOW SWITCH IS ADJUSTABLE

Control device which responds to a flow of cold water has been announced by General Electric's Control Div. In operation, it closes a contact when flow exceeds a preset amount and opens it when the flow falls below, and acts as a fuse in a circuit which depends upon water cooling for protection. According to G-E engineers, the interlock

can be used as a safety device in many other applications where it is desirable to actuate an electrical contact with a flow of water, as in hot water heaters, welding units, kitchen waste units, transformer cooling, induction heating, television luminaires and water-cooled dynamometers.

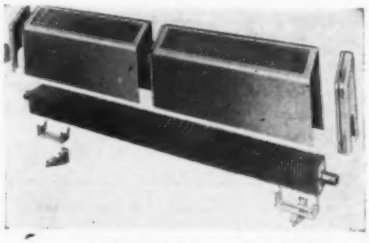
Adjustment can be made to control the circuit for any flow from one to four gpm. The differential between the cut-in and the cut-out of the electrical contact is 0.2 gpm to 0.4 gpm max and operates for the amount of flow independent of pressure. Electrical rating is 10 amp at 125 v, 5 amp at 250 v, and 3 amp at 460 v, all a-c. Maximum line pressure is 125 psi.

326—WALL-FIN RADIATOR GIVES HIGH SPOT HEATING

Wall-fin type radiation for a variety of commercial and industrial applications has been developed by The Trane Co. Important design advances include easily-installed cabinets in standard unit lengths that lock together with push-in rivets, and a hanger that rides with expansion and contraction of the heating element.

Steel pipe and non-ferrous heating

elements are available in standard lengths from 2 to 12 ft in 6 in. incre-



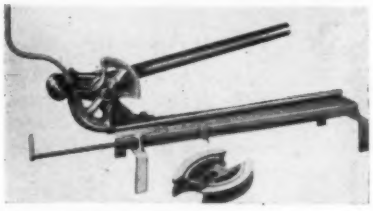
ments. Cabinet sizes are from 2 to 6 ft in 6 in. increments and grilles range from 2 to 10 ft in 6 in. increments.

Wall-fin radiation provides "high spot" heating around skylights, exterior walls, windows and other points of high heat loss in industrial applications. The wall-fin elements create a "blanket of heat" of any desired length along strip, show and picture windows.

327—CONDUIT BENDER EASY TO OPERATE

Latest labor saving bending device developed by Tal Bender, Inc. instantaneously makes any number of uniform conduit bends to any desired degree. No guess work, no special adjustments are necessary—it has a measuring gauge and bend degree indicator to control precision bends made by inexperienced workmen on the job.

Especially recommended for open or slab work, where small or large numbers of bends are required—it operates easily, without special knowl-

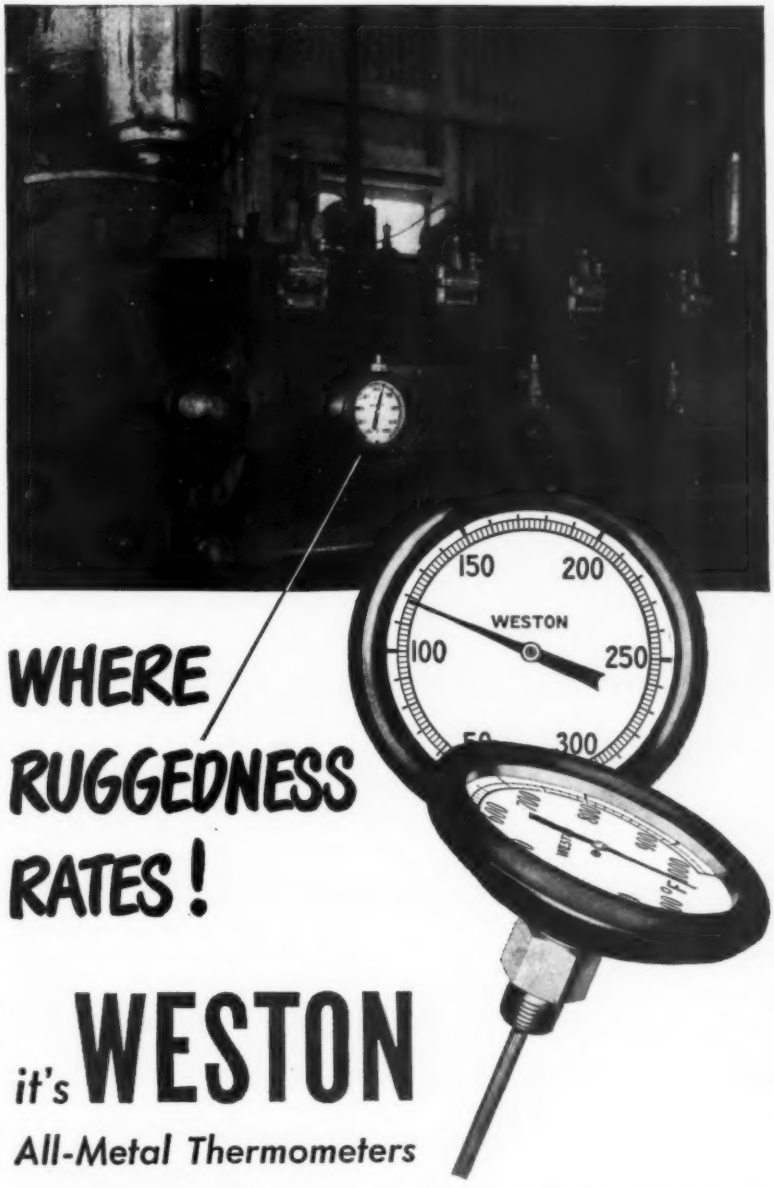


edge. Made from light weight metal the unit is well constructed to assure long life. The weight is 30 lb.

328—SYNCHRONOUS MOTOR CONTROL UNIT AVAILABLE

Full or reduced voltage synchronous motor control units, for operating and protecting all types of synchronous motor drives, are available from Westinghouse Electric Corp. The units are supplied as factory-wired units, requiring only external connections when installed.

Polarized slip-frequency relay, with associated control, provides automatic synchronization with maximum pull-in torque at the proper speed and phase relation, thus minimizing line disturb-



Where the going is tough, WESTON thermometers get first call. Their rugged construction—all-metal throughout—enables them to stand up on pumps, compressors and mobile units. And the big, bold dials are easy to read—quickly and accurately! There are many types, stem lengths and scale ranges from which to choose. Ask your jobber or local WESTON representative, or write for Thermometer Bulletin. WESTON Electrical Instrument Corporation, 637 Frelinghuysen Avenue, Newark 5, New Jersey.

CONTACT-MAKING models for alarm or control purposes. MAX-MIN models to indicate highest or lowest temperature reached.

WESTON Instruments

Monsanto
SANTOSITE
stops
oxygen corrosion
in boilers

Santosite (Monsanto sodium sulfite anhydrous, technical) removes dissolved oxygen from boiler feed water . . . puts an end to steam plant damage and shutdowns due to oxygen corrosion. Santosite is economical . . . efficient . . . easy to apply.

If oxygen corrosion is a problem in your boilers, you will profit from reading Monsanto Technical Bulletin No. O-26. For your free copy, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk B, Organic Chemicals Division, 1743 South Second Street, St. Louis 4, Missouri.

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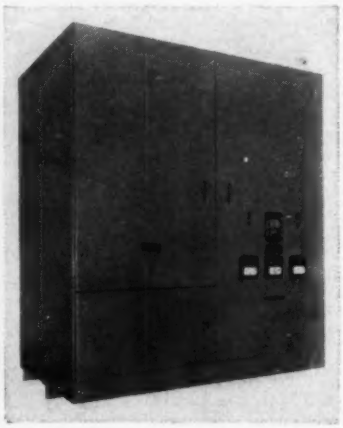
CHEMICALS for PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

ance. Pull-out protection is incorporated to stop the motor automatically if it pulls out of step. Provision for resynchronization of the motor after



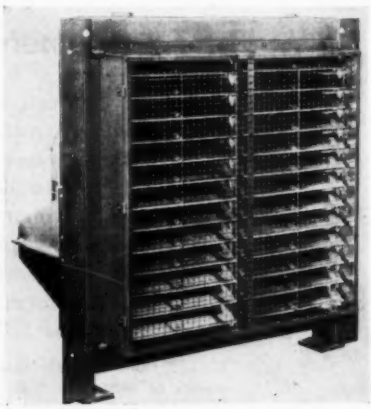
pull-out can be made if desired, and if load conditions permit.

One thermal protective relay guards the stator against sustained overloads; another guards the rotor damper windings against failure of the motor to start. Time delay, under-voltage protection can be supplied on all models.

329—CORROSION-RESISTANT COOLING RADIATOR

Special design details have been incorporated into jacket water cooling radiators by Young Radiator Co. Designed to meet the customer's requirements, this unit provides the answers to difficult problems.

Special treatment of metals makes the unit practically corrosion resistant. All major ferrous parts are zinc plated. The nuts, bolts, screws and washers



are cadmium plated. The natural corrosion resistance of copper, brass and aluminum protect the actual core and cooling parts of the unit. To further protect the radiators against corrosion, a priming coat of zinc chromate has been applied followed by a coat of gray enamel.

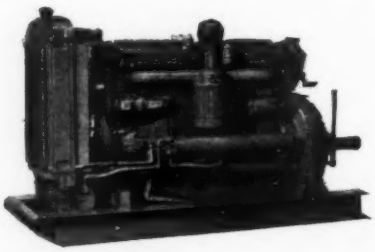
Radiator is designed to maintain a maximum jacket water temperature of 180° F with a maximum of 120° F ambient air temperature. A 173-hp diesel engine running at 720 rpm driving a 100-kw generator can be readily cooled.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

330—IMPROVED DIESEL DESIGNS ANNOUNCED

Murphy Diesel Co. has recently announced certain refinements in design which are claimed to provide more power, greater economy, greater dependability and longer life. At the same time the number of models has been increased. Five 4 cylinder models and six 6 cylinder models ranging in output from 90 to 200 hp are now available.

The Murphy principles of diesel operation, plain open combustion chamber, four valves per cylinder, and hy-

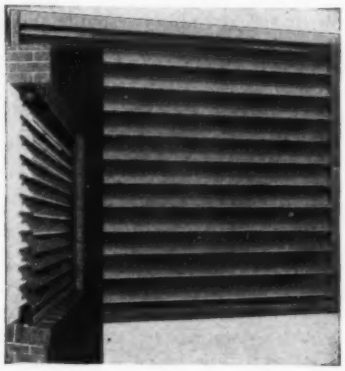


draulic servo-type governor, remain as the basis of the design of the engines. The additional power output results from improvements in the application of these principles.

331—WEATHER-PROOF LOUVERS PERMIT FLEXIBILITY

Improved construction methods are claimed by The Swartwout Co. for a system of industrial and commercial building louvers ready to be marketed under the name "Airlouver". Heavy duty frame and overlapping blades, weather-proof in both open and closed positions, are fabricated under a flexible set-up permitting almost unlimited selection of sizes. With 74¾ x 48 in. as maximum dimensions for a single unit, sizes as small as 11⅞ in. high and 12 in. wide can be obtained. By varying the number of blades used and cutting the frames to suit width requirements, any size wall opening can be fitted with a pleasing pattern of equal-size units. Made in adjustable

and fixed types, galvanized steel is the standard material used, but fabrica-

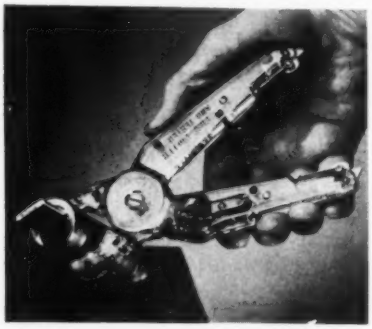


tion can be of copper, aluminum, monel or APM. Rigidity is emphasized to resist the distortion of heavy air flow conditions.

332—CIRCUIT TESTER ALSO FUSE PULLER

Electrical shock-proof pliers can be employed either as a circuit tester or fuse puller on a-c or d-c lines from 110 to 600 v. The pliers are molded from plastic, and they will not chip, splinter or shatter.

Circuits can be safely tested with accuracy, as a no-leak test lamp eliminates any false glow. This test lamp will not light on a dead line, floaters, open circuit or on one leg of a transformer. It can be utilized to detect de-

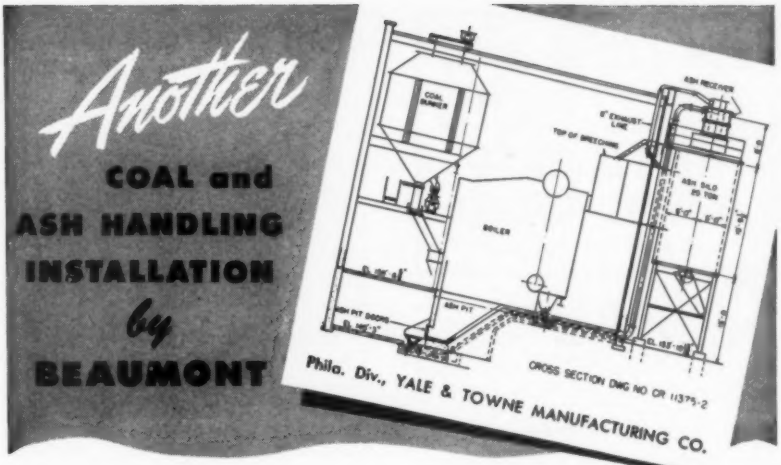


fects in motors and appliances, test lines for blown out fuses and tracing short circuits and grounds safely and quickly.

Employed as a plier, fuses up to 100 amp rating can be removed surely and efficiently with no danger of shock. Available with two ft leads for greater reach and flexibility. Star Fuse Co., Inc.

333—AUTOMATIC TRANSMISSION HAS 5 HP CAPACITY

Variable-speed V-belt transmission, with characteristics similar to a true hydraulic torque converter, is now in



Here's one of the many efficient coal and ash handling installations—designed, manufactured, installed *by Beaumont*. The above system is operating at the Philadelphia plant of Yale & Towne Manufacturing Company. This plant saved both time and expense—through one-contract-economy . . . But you're right! It's up to us to convince *you* of the advantages in a *Beaumont* installation: So let us send you our folder of typical installations. Write to:

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HENSZEY *Boiler Feed* REGULATOR
Keeps a WATCHFUL EYE *on* BOILER WATER LEVELS
• CONTINUOUSLY • AUTOMATICALLY • ACCURATELY
under ALL LOAD CONDITIONS

They help avoid the hazards of high, as well as low, water levels. They function night and day—once installed and set for operator no attention is necessary—nothing to get out of order — nothing to rust.

A simple, compact unit — installs right in the line—no additional supports are necessary. Pressures up to 600 lbs., sizes up to 4 in. For details consult Sweet's Catalog or write:

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New data is included on basic Nuclear Engineering; Gas Turbines material, with applications to aircraft, power, locomotive and marine installations; data on Coals from major American mines; 20 greatly-enlarged sections of the Mollier chart (never before available); tables of Theoretical Steam Rates; Heat Gain in air-conditioning applications; abundant illustrative and tabular data on Diesel Locomotives; and comprehensive treatment of Air and Marine Transportation. *May 1950. 1409 pages plus index. $8.50.*

DESIGN AND PRODUCTION

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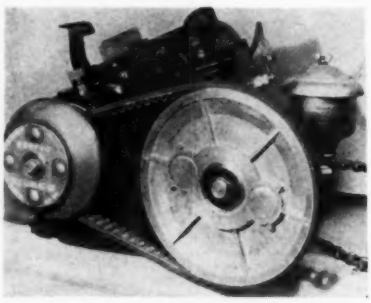
production by Diesel Pump and Electric Mfg. Co. This transmission combines automatic-clutch action, simple



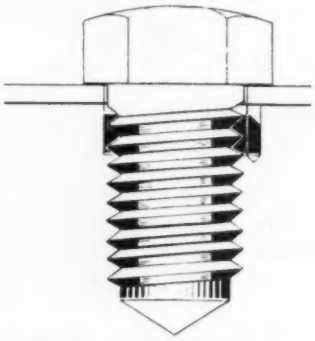
speed-responsive automatic shifting, automatic torque-responsive action, and infinitely varying ratios between 4 to 1 and 1.6 to 1, depending upon the speed and torque applied. Belt life is reported to be high, because of reduced side pressure during normal operation.

Principle parts are high strength aluminum alloy, pressure die castings with steel inserts for hubs. All steel parts are rust-proofed. The whole mechanism is compact, with a minimum of moving parts. No lubrication is required.

Available for applications up to 5 hp, a larger transmission, in the 10 to 15 hp range, is now approaching production, and a 30 hp unit is under development.

334—ELIPTICAL RETAINER LOCKS STUDS AND BOLTS

Eliptical spring steel retainers have been applied successfully for locking studs, bolts and other threaded parts in mechanical assemblies by Security Locknut Corp. The stud or bolt forces the eliptical retainer into circular shape, creating rigid locking pressure on the threads. The stud or bolt may



be adjusted to any position and will remain in position regardless of severe vibration. The retainer floats in a counterbore and carries no load. All tension or compression stress load is carried by threads in the tapped hole.

Stud or bolt can be applied repeatedly without distortion to retainer or bolt. Initial assembly is simple and in many cases costs less than conventional stud locking methods. Made in standard stud and bolt sizes from $\frac{3}{8}$ to 2 in. in both NC and NF thread series. In addition, special sizes can be engineered to suit job requirements.

335—TIME-DELAY RELAY RESTARTS MOTORS

Motor control accessory has been designed by Square D Company for use with a separate motor starter and pushbutton station to provide automatic restarting after a momentary voltage fluctuation or power failure of a few seconds duration. If the power failure is prolonged more than a few seconds, the relay circuit disconnects

the motor from the line, protecting operators and machinery from unexpected restarting upon restoration of power.

Automatic restarting is assured if the voltage returns to 85% of normal within the time for which the device is set. It can be adjusted to give approximately 2 seconds or 4 seconds time delay.

Time delay low voltage release devices are available in NEMA Type I general purpose (sheet steel) enclosures or in NEMA Type VII explosion-proof (cast iron) enclosures for Class I Group D hazardous locations. They can be used with a suitable motor starter for control of a-c motors rated up to 200 hp.

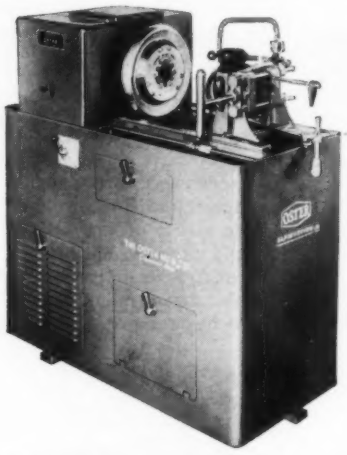
336—PIPE MACHINES HAVE ¼ TO 2 IN. CAPACITY

Four 2 in. threading machines of the same basic design but with different types of die-heads and workholders permit selecting the most suitable machine for each user's needs.

Models Nos. 782 and 782-R are pipe threaders with the same range of ¼ to 2 in. Both have a bolt range of ¼ to 1½ in. Models Nos. 781-A and 782-A are bolt threaders with the same standard bolt range of ¼ to 1½ in.

Pipe range of No. 781-A is ¼ to 1¼ in.; No. 782-A range is ¼ to 2 in. pipe.

All four models are equipped with 2 hp constant speed motors, 900 to

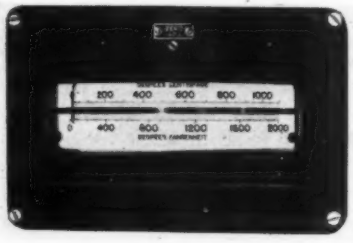


1800 rpm. Other identical features include hardened and ground worm and bronze worm gear, and anti-friction bearings throughout. Spindle speeds are 25-50-100-200 rpm on models Nos. 782, 781-A and 782-A and 25-50 rpm on model No. 782-R. The Oster Mfg. Co.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

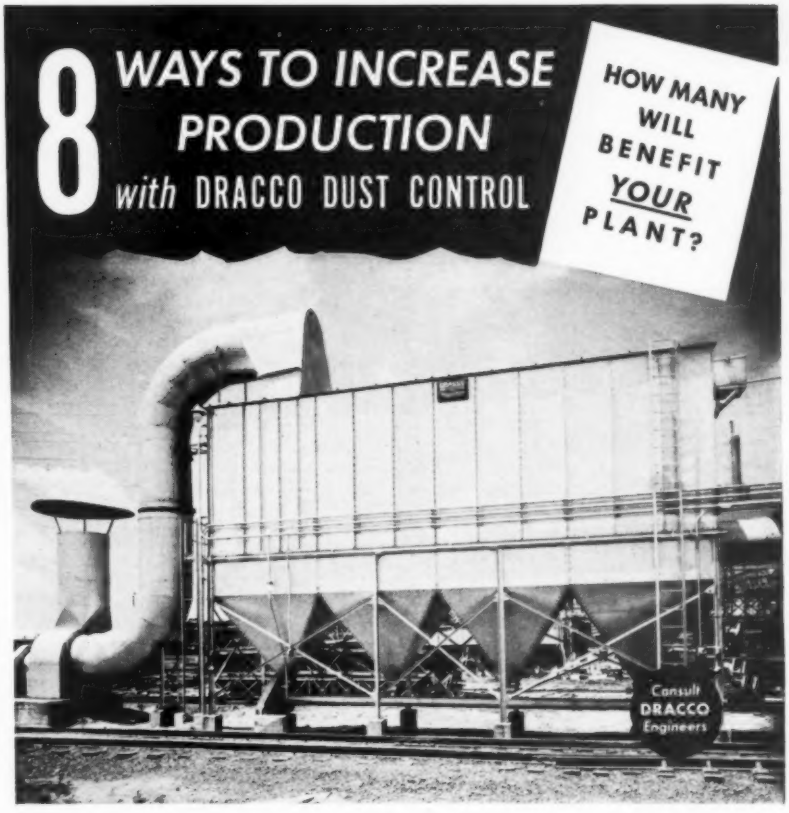
337—FLUSH MOUNTING PYROMETER FEATURED

Wheelco Instruments Co. has just announced a compact indicating pyrometer, Model 192, for flush and surface mounting. The unit is designed for applications where size of the



heating equipment or space limitations demand the use of a small and economical instrument.

High resistance "edgewise" magnetic movement and wide open mirrored scale is fully compensated and enclosed in a dustproof housing. Model 192 with front dimensions of only 7½ in. wide and 5 in. high is the ideal quality indicator to be used by



Dust in small or large amounts slows up production. DRACCO Dust Control ALWAYS increases efficiency. How many of the 8 factors will benefit YOUR plant? 1-Recovery of valuable materials, 2-Healthier and happier workers, 3-Increased efficiency of plant, 4-Reduced cost of equipment repair, 5-Eliminates occupational diseases caused by dust, 6-Stops complaints by neighbors, 7-Eliminates expensive law suits, 8-Complies with State laws and City ordinances. Every installation is benefited by several. Have DRACCO Engineers analyze your dust problem. They have over 35 years' experience in dust and fume control. Why not consult them now?

For Further Information Write

DRACCO CORPORATION

4046 E. 116th St., Cleveland 5, Ohio New York Office: 130 W. 42nd St.

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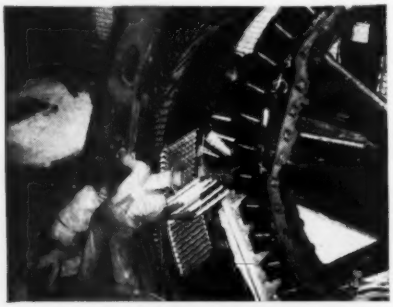
PNEUMATIC CONVEYORS • METAL FABRICATION

MAHOMET DID IT ... and so does HYRE!

The size of a motor or generator job is no obstacle to us. If it's too large to move, we move to the job—just as we are doing in the photo here. That is a 4,000 kilowatt generator located in the Sanitary District of Chicago powerhouse at Lockport, Illinois, with a crew of Hyre specialists in the process of rewinding the giant field coils. Jobs of that kind aren't exactly one-day affairs, but they are all in the day's work to Hyre Electric Company.



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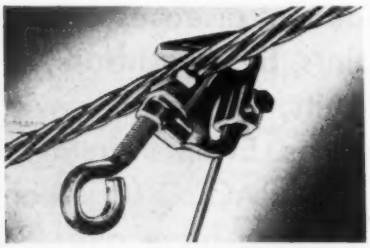
INDUSTRIAL-COMMERCIAL LIGHT AND POWER

manufacturers of smaller type heating equipment, such as laboratory furnaces, as standard built-in accessory.

338—LINE CLAMP TAKES WIDE RANGE OF WIRES

Reliable Electric Co. has announced its 408C hot line clamp for copper and copperweld conductors that ac-



commodates 4/0 strand to 6 solid line wire and 3 No. 6 to 8 solid tap.

This clamp is made of cold forged, work-hardened copper, while the eye screw, tap screw and pressure bar are silicon bronze. The tap wire connector is a seamless copper extrusion. Accurate design provides components that align perfectly for drilling and tapping. Forged grain structure is claimed to provide uniformity and conductivity far in excess of castings. Unit can be furnished for steel, aluminum over steel and copper application.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

339—RATCHET DRIVE HAS RING SHIFT

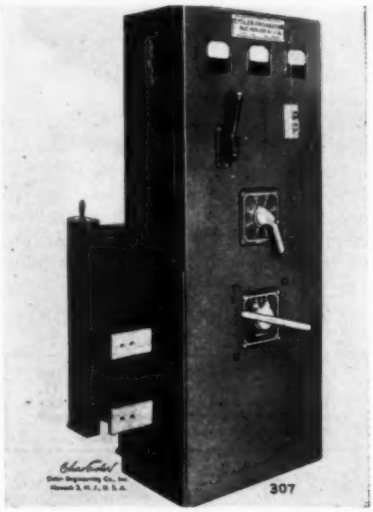
Introduced by the Herbrand Div. of the Bingham-Herbrand Corp. as a companion model to its ½ in. drive ratchet the new model fits all-⅜ in.

drive handles and sockets and features a simple ring shift for converting to right or left drive. It makes a ratchet extension when attached to any ⅜ in. drive T-handle, flex handle or extension handle. Sealed to keep out dirt and grit, there are 20 teeth for secure grip at any position. It is only 1⅛ in. wide and weighs 5½ oz.

340—LOW-VOLTAGE TRANSFORMER FOR HEATING APPLICATIONS

Low voltage, heavy current transformer of modern design for heating applications complete with control panel has recently been developed by the Eisler Engineering Co., Inc. Available in a wide variety of kva capacities up to 500 and in any required combination of voltages and frequencies.

By suitable arrangement of tap changing switches any one of 16 volt-



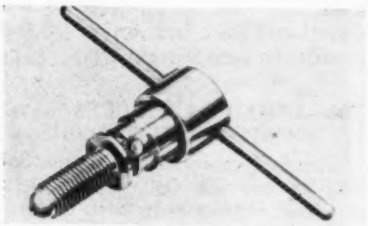
ages may be selected at will. All switches are interlocked to prevent their operation with load on the transformer. The control equipment includes, in addition to the tap switches, a magnetic contactor and suitable indicating meters for voltage and current. In other cases additional equipment such as recording meters, safety entrance switches and various arrangements of tap switching are supplied.

341—PRESSURE BOLT HAS SAFETY RELEASE

Thomas C. Wilson, Inc. has announced a line of safety release pressure bolts that have proved to be a necessary safety factor in oil burners, strainers and for securing covers of many types of pressure vessels against unsafe opening.

Safety release pressure bolts are actuated by the pressure within the vessel. A hole through the bolt body conducts the fluid under pressure to a piston within the bolt head and causes the handle-bar to be moved and

held out of bolt turning position. When under pressure the handle may be freely rotated without imparting



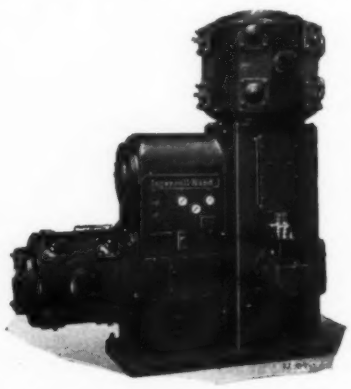
turning movement to the bolt proper. When the pressure is released the handle automatically returns to bolt-turning position and the member secured by the bolt may be safely removed.

This easy to install pressure bolt offers positive protection to all power and industrial plant owners and operators where safety is of the utmost importance.

342—AIR COMPRESSOR FEATURES COMPACT DESIGN

Announced by the Ingersoll-Rand Co. in sizes from 125 to 350 hp for continuous full-load service and two-stage compression to 80-125 psi discharge pressures, these electric driven compressors stress simplicity of design, operation and maintenance, as well as operating economy and compactness. The design embodies a vertical low-pressure compressor cylinder, a horizontal high-pressure cylinder, and a synchronous motor mounted directly on the crankshaft. It requires only a small foundation.

Air enters and leaves the compressor through main air connections on



the frame and is led to and from both cylinders and intercooler through large passages within the frame itself, eliminating interstage piping and cylinder strain. The intercooler fits entirely within the same frame. Counterflow, tube-and-finned construction of the intercooler gives excellent cooling with

TWIN-WELD HOSE SPEEDS WELDING—

eliminates tangled lines

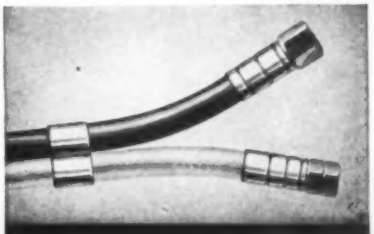
That's right—with Hewitt-Robins patented* Twin-Weld Hose, you have *two* hoses but only *one* line to handle! This modern hose gives *double* safety, *double* convenieence, to acetylene welding equipment.

Twin-Weld's green oxygen line and red acetylene line are actually *bonded into one piece*, yet separate easily for coupling to tanks and torch. Gone is the dangerous mass of tangled individual lines. Instead, the operator has one neat, flexible, non-kinking line that makes his job safer, his work quicker and more efficient.

Twin-Weld saves time in getting welding equipment into operation, makes it easy to reach the work, change position at will, or work in close quarters.

*U. S. Patents 2,122,335 & 2,136,220

For all welding, cutting and chipping service, there's no better hose made! Call your Hewitt-Robins distributor, listed in the classified telephone directory, or write Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, N. Y.



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Twin Weld Hose

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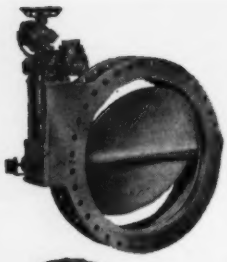
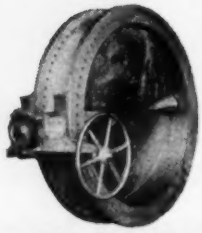


Butterfly valve, 42" pipe size, 125 lbs. flanged drilling, complete with motor and remote control having a torque of 300 ft. lbs. Streamlined blade moves on needle bearings; may be operated by auxiliary hand wheel.

•

Wafer type butterfly valve for close pipe coupling, 36" pipe size, with air diaphragm operator and pilot valve.

•



Butterfly valve 66" pipe size, hand wheel operated for a 7½ lb. air line in the power and blower division of an activated sludge plant. Yes, this is big, but we build them even as small as 1" size —cast or fabricated—for handling anything from fly ash to corrosive vapors containing abrasive particles, river water or high temperature gases or liquids, paper pulp, etc.

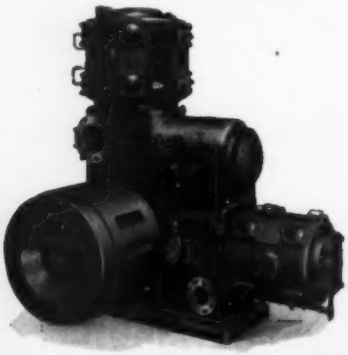
Rockwell slide (gate) type and butterfly valves for air, gas, liquids and semi-solids are available in pipe sizes to 84" — in all metals — with any manual or mechanical controls.

ROCKWELL BUTTERFLY VALVES

W. S. ROCKWELL COMPANY • 230 Eliot St., Fairfield, Conn.

very little pressure loss and a small quantity of water. Intercooler is made of all-copper alloy throughout.

All bearings are full-floating and main and crankpin bearings are of



aluminum alloy. Pressure lubrication is in a sealed dust-tight crankcase that need not be opened for bearing adjustment. The compressor is particularly suitable wherever skid-mounting, factory floor, or ground conditions require a well-balanced machine.

343—SHOP ON WHEELS FOR INDUSTRIAL USE

This cabinet provides the user with a shop that can be rolled right to the job carrying all necessary tools, equipment and material. The top provides a rigid work surface capable of mounting a vise or bench grinder.

Constructed of extra heavy gauge steel and spot welded throughout there are seven drawers of various sizes equipped with ball-bearing "slide-runs". Additional storage space for larger items is furnished by two compartments and the back of the cab contains a series of 20 small bins for nuts, bolts, washers, etc. All drawers and compartments can be locked when the

cab is not in use. Also provided are a swivel light on top, an electrical supply inlet and two double outlets. Running gear consists of roller-bearing, rubber-tired wheels, two of which swivel, and independent foot brakes.

Overall dimensions of the unit are 45 in. long, 24 in. wide and 36⅜ in. high. It is finished in baked-on red enamel and has a net weight of 388 pounds. Snap-on Tools Corp.

344—CHEMICAL REDUCES WATER PAINT FOAMING

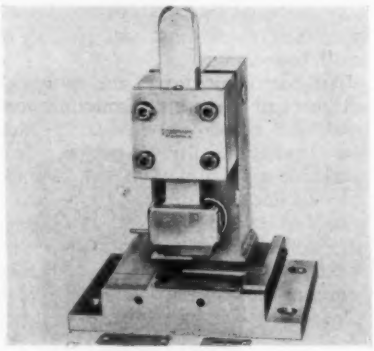
Chemical, manufactured by the Socony-Vacuum Oil Co., Inc., with a petroleum product as its base, is being utilized by the paint industry as a defoamant in water-base paints.

Officials of this company state this product permits use of emulsion equipment at full capacity by decreasing the foaming. In addition, its utilization overcomes a difficulty in the packaging operation where excessive foaming impedes accurate measuring into containers.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

345—STAMPING FIXTURE PREVENTS SPALLING

Hand stamping fixture for marking metal name plates has been announced by the M. E. Cunningham Co. Designated Model SF-100, this tool has been designed to prevent spalling, mushrooming and injury to personnel.



It can be fabricated to order for processing one or a group of name plates, checks and other flat metal objects. Chase section in the bottom of the holder has adjustable horizontal and vertical gauges that are locked and adjusted by standard thumb screws or set screws.

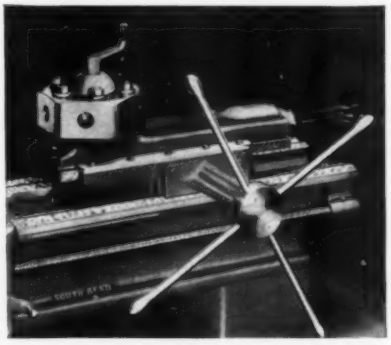
Hardened and precision-ground, the holder fits into the upper arm of the machine and after each stamping is pulled away from the plate by a spring return. The arm operates on a swivel which swings upward when type is to be changed, and the holder does not

have to be removed to change type. During striking operations a utility hook retains the type in the holder. This hook is easily removed for quick type changing.

346—TURNSTILE-BED TURRET FOR 16 IN. LATHES

The South Bend Lathe Works is now producing a hand feed, turnstile operated, bed turret as an accessory for their 16 in. swing lathes, which mounts without changing the basic lathe in any way. The turret can be removed at any time and the tailstock remounted for regular lathe work.

The turret can be locked in position at any point along the usable length of the lathe bed. The turret base is designed to clear the saddle wings so that the hexagon turret head can be positioned close to the spindle nose, eliminating excessive overhang of the turret tools. Double gibs provide precision adjustment for the turret slide. The turret ram has stop screws which



index automatically with the head. The six-tool turret head may be back-indexed or spun to skip tool positions with a crank-type binder lever provided for locking. Accuracy is plus or minus .0005 in.

For more information use one of the convenient reply cards on page 71. No postage necessary. Circle the key numbers of items about which you want additional information.

347—EMULSIFIED OIL REMOVED FROM WATER ECONOMICALLY

Johns-Manville has announced a specially processed high flow-rate diatomaceous silica celite powder that has the property of removing oil from water. Like other celite powders, it is composed of diatoms—minute porous particles of varied shapes and sizes. These tiny treated particles have the ability to adsorb and "trap out" emulsified oil globules when an aqueous suspension of these globules is passed through it. The material is used in a pressure filter similar to that employed in the many conventional industrial filtrations that utilize celite filter powders.

348—SAFETY GOGGLE HAS HEAD ADJUSTMENT

Headrest goggle with adjustment to any size for gas welders, cutters, burners, brazers and furnace men has been

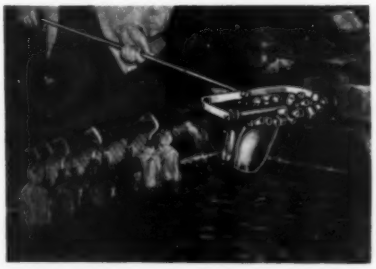
announced by American Optical Co. A slight twist of a knob adjusts the goggle to the wearer's head size.

Headgear provides perfect balance with no overhanging weight and the goggle may be instantly changed to the "off-guard" position by a flick of the wrist.

Designed to be worn over eyes or personal glasses, the goggles have well ventilated, indirect side shields to keep out sparks, metal splashes and stray light rays. The headrest goggle may be obtained with either Noviweld or Noviweld-Didymium lenses in several shades; replaceable cover lenses are provided to protect these more costly filter lenses.

349—METAL PARTS RETRIEVED WITH TANK MAGNET

Eriez Mfg. Co. has announced a low-cost permanent magnetic device for removing ferrous parts and con-



tamination from electroplating tanks, alkali baths and acid baths.

Made of stainless steel, the tank magnet is temperature-proof, acid and alkali-proof. It is operated very much like a carpet sweeper with the magnetic tube mounted between neoprene

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- No Overtaxed Switchboard

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wheels. Ferrous material moves to the magnet and spreads itself over the entire circumference to a thickness of about ¾ in. Unloading is accomplished at either end of the tube by pushing the upper ring from one end to the other, where a non-magnetic section causes the load to be released.

The unit is light and easy to handle. Parts that are collected will not be detached in the tank. 48 in. overall length; 16¼ and 21⅛ in. widths.

350—PAINT USABLE AT 1,000 TO 1,500 F RANGE

"Heat-Rem" high-heat-resistant aluminum paint has recently been improved by the addition of silicone, according to an announcement by the manufacturer, Speco, Inc. Silicone is reputed to enhance the paint luster and to provide smoother coverage with greater weather resistance. Increased water repellence is another feature.

Made specifically for use on exterior and interior metal surfaces, this paint is usable at temperatures ranging from 1,000 to 1,500 F. It fuses with the surface metal to form a bright elastic finish resistant to moisture, corrosion, mild acids, alkalis and industrial fumes. Setting time is said to be 4 hr. It will dry completely overnight. It is recommended for use on heat lines, radiators, condensers, compressors, ovens, exhaust manifolds, engine heads, and mufflers.

351—GEAR TYPE BENDERS FEATURE PRECISION

Announced by The Imperial Brass Mfg. Co. the high gear ratio of these benders is said to make bending easy. Other features emphasized are compactness, light weight and quality of bend. They are designed for use with copper, brass, aluminum or steel tubing, including thin-wall conduit. There are individual benders for ½ to 1⅛ in. OD tube sizes, or ⅜ to 1 in. nominal. There are also combination benders which take several sizes.

Bends can be made to any angle up to 180°. Tubing will not flatten or kink, it is stated, due to close precision fit and fact that bends are formed by an action similar to original drawing of tubing. Because benders are of open side type, they can be slipped over tubing at exact point bend is desired without disassembly of any part. Benders are designed to be held in the hand or clamped in a vise.

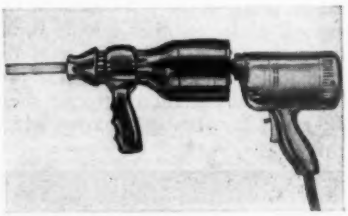
352—QUICK ALKALINITY INDICATOR ANNOUNCED

Total alkalinity indicator is a recent development of the Power Chemicals Div. laboratory of E. F. Drew & Co., Inc. The end point occurs at exactly the same pH as methyl orange. Applied in exactly the same manner as methyl orange it gives a clearer and more distinct end point. This not only provides quicker, more accurate analysis but is particularly necessary in the case of colored and turbid solutions.

Green in color when in alkaline solutions, the greenish color changes to grey just before the end point is reached, and at the end point, the grey changes to purple.

353—ATTACHMENT SAWS METAL, WOOD, PLASTICS

Designed for power operation by any standard drill of 2000 or more rpm, a hack saw blade is inserted in holder with teeth toward operator so



saw cuts on the "pull" stroke. When power is applied by operator the blade operates with a rapid ⅞ in. stroke to make clear cuts—leaves no jagged edges. As teeth lose sharpness about ½ in. of end of blade may be broken off. For filing, an ordinary file is inserted in holder, locked tight and is ready for duty when the operator turns on power. Mid-States Welder Mfg. Co.

354—SANITARY ALL STEEL WASTE RECEPTACLES

Industrial Products Co. announces a new line of sanitary, all steel waste receptacles. Made of heavy gauge furniture steel each receptacle is fitted with two, independent, self-closing

doors which swing in and may be used at the same time without interference with one another.

They are fitted with separate inner bag or metal container, either of which may be easily removed for disposing of contents. Top section is hinged and may be turned back for full access to the inside of the receptacle. The range of sizes is from 11½ x 11½ x 24¾ in. high to 21 x 21 x 46 in. high.

Power Plant Cycles

(Continued from page 89)

ess. Total process requirement is about 1,300,000 lb per hr.

This plant has extensive boiler-water and process-water treating facilities. A reservoir with 22,000,000-gal capacity is located adjacent to the power plant. In addition, there is a 600 ft cooling tower with a capacity of 120,000 gpm. The plant electrical system is tied in with the local utility, and excess power can be put into utility lines; of course, power is drawn from them in cases of emergency.

Conclusion

The three articles in this series have brought out several important points that can be summarized as follows:

1. Private power generation is *usually* uneconomical when a demand exists only for electricity, and where there is a local utility that can serve the manufacturing enterprise.

2. Private power generation is almost invariably more economical than purchased power when a moderate or large demand exists for both steam and electricity.

3. There is a definite fuel consumption ratio for heating and process below which purchased power is cheaper and above which it is more expensive.

4. Exact coincidence of steam and electrical demand provides the best loading for an industrial power plant; demand divergence, within limits, is permissible and is generally the case in industrial power plants.

5. Where industrial load is predominantly steam, backpressure turbines are frequently the best investment.

6. Relatively large electrical loads indicate condensing extraction turbines.

7. An industrial plant operates at maximum efficiency when all the process steam passing through the turbine generates just the needed electrical energy.

8. Pressure - temperature reduction without production or work will waste energy. It should be avoided wherever possible.

9. Well designed industrial power plants have heat rates which are generally far less than those obtainable in first-rate utility plants.

10. Turbine and process heat consumption should be charged proportionally, and boiler losses pro-rated equally among all units of energy applied to the steam while in the boiler.

NEW BULLETINS

(Continued from page 20)

To obtain any of these free booklets circle the corresponding letter on one of the convenient post cards on page 71.

Air Tools (QQ) Illustrated 44-page catalog contains complete specifications on 147 different types and models of portable air tools and their accessories. Many new tools, recently designed, are shown for the first time. Applications for each tool are reviewed. Buckeye Tools Corp.

VALVES, PIPING AND FITTINGS

Traps (RR) Factual, illustrated 32-page catalog describes five types of thermostatic steam traps for operating pressures to 225 psi; two types of expansion steam traps for pressures to 250 psi; three types of weight-operated traps for pressures up to 1500 psi and piston-operated traps for pressures up to 650 psi. Capacity tables and installation data are included. W. H. Nicholson & Co.

Oil Seals (SS) Brochure is a sixteen page handbook of useful data for anyone needing information on oil seals. Photographs show application and installation details. Drawings illustrate how the lip and heel construction of these non-metallic oil seals can be varied. The text gives other pertinent information of importance to designers, engineers and maintenance men. Johns-Manville.

Welding Fittings (TT) Working catalog that contains 88 pages covers the complete line of this manufacturer's welding fittings and flanges. Specifications, price list, sizes and dimensions are included for standard, heavy and extra heavy fittings. Helpful index, located inside the cover, aids in readily finding any type of fitting or flange. Grinnell Co., Inc.

Automatic Valves (UU) Colorful and well illustrated 32-page bulletin gives a clear picture of this company's line of automatic pressure reducing valves, strainers, hotwater heat controls and relief valves. Specifications and operating features are explained in detail. Capacity and dimensional tables are listed. A. W. Cash Valve Mfg. Corp.

Steam Traps and Controls (VV) Catalog contains 36 bulletins that cover this manufacturer's line of steam traps, vents, temperature regulators, degreaser controls, cooling controls, mixing valves, water blenders, thermostats, and strainers. Each bulletin covers specifications, selection data, dimensional tables and recommended applications. Sarco Co., Inc.

Steam Equipment (WW) Condensed 12-page catalog covers a portion of this company's steam plant equipment such as: high and low pressure blow-off valves, water columns and gages, liquid level indicators and recorders, expansion joints, steam traps and strainers. Specifications and selection data are included. Yarnall-Waring Co.

HEATING, VENTILATING AND AIR-CONDITIONING

Packaged Air Conditioners (XX)

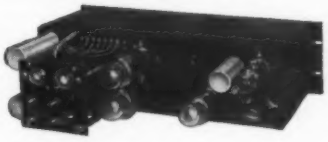
STABILINES

SPEED UP

SLOWDOWNS

Stopping and starting of machinery, motors and other electrical equipment cause load fluctuations resulting in equipment slowdown. To speed up slowdowns, install STABILINE Automatic Voltage Regulators to maintain constant voltage.

TWO TYPES AVAILABLE



STABILINE TYPE IE operates instantaneously, electronically, to keep delivered voltage to within ±0.1 volts of preset value, regardless of line variations. Holds output to within ±0.15 volts for any load current change or load power factor change from .5 lagging to .9 leading. Waveform distortion *never* exceeds 3%.

STABILINE TYPE EM operates electromechanically. Features zero waveform distortion, complete insensitivity to magnitude and power factor of load; no effect on system power factor, no critical adjustments; high efficiency, adjustable output voltage. In 115, 208, 230, 440V, 1- and 3-phase ratings; capacities to 100KVA.

There's a STABILINE Voltage Regulator for every need. Write for literature today.

THE SUPERIOR ELECTRIC COMPANY

1506 MEADOW STREET

BRISTOL, CONN.

Two-color 12-page catalog covers a complete line of packaged air conditioners. Units come in 2, 3, 5, 7½ and 10-hp capacities. Descriptions and illustrations are included for all conditioners, and a cutaway drawing shows how the packaged unit operates. Standard ratings, rating conditions, and dimensions are also given. General Electric Co.

Unit Heaters (YY) Bulletin on turbine driven unit heaters covers the unique features of this company's heater. The electric motor, for operating the fan, has been eliminated. This unit is driven by a steam turbine, the exhaust from the turbine being piped into the heater section for heating the air. Complete details, which include engineering data and dimensions both on the revolving discharge units and the fixed discharge units, are given. L. J. Wing Mfg. Co.

Ventilating Guide (ZZ) Guide provides a concise yet thoroughly informative coverage of general industrial ventilation problems and their economical solutions. Some of the important headings within the guide are "Types of Ventilation", "System Pressure", "Recommended Air Changes", "Duct Resistance Chart", and "Calculation of Resistance". Propeller Fan Manufacturers Association.

Pressure Tanks (AAA) Bulletin on pressure tanks for airblasting describes tanks operating continuously and intermittently. Pictures and detail drawings are included. The tanks are convenient, semi-portable and ideal for high and low pressure blast cleaning, for cutting monument inscriptions, and for similar work. American Wheelabrator and Equipment Corp.

Dust Control (BBB) How all the savings of dust control can be initiated, even in an industry so plagued by dust as foundries, is the story told in a new folder titled "Foundry Dust Control . . . and Sand Conditioning" Typical installations are explained and illustrated. Aquadyne Corp.

MISCELLANEOUS

Vibrators (CCC) Descriptive eight-page bulletin covers both electrical and mechanical operated vibrators for mass concrete puddling. Photographs illustrate the numerous field applications for slab, bulkhead and reinforced concrete construction. All units are portable. Syntron Co.

Publications (DDD) Bulletin entitled "List A" contains listings of important articles published on nickel alloys, stainless steels, nickel cast irons, nickel brass, bronzes and nickel plating that have appeared in recent publications. Articles are listed alphabetically under the above subjects. The International Nickel Co., Inc.

Water Heater (EEE) Colorful four-page bulletin covers the features of a safety water heater that utilizes high pressure steam. Installation and operation of these units are explained and illustrated in detail. Specifications—for water temperatures to 120 F—dimensional line drawings and selection data are included. The Coe Mfg. Co.

Processing Tanks (FFF) Four-page bulletin explains fabrication methods in the construction of this company's petroleum, food, chemical, soap and metal treating tanks. A discussion of how the problem is handled by the company's engineers and selection of materials is given. Graver Tank & Mfg. Co., Inc.

Floor Machines (GGG) Colorful six-page folder gives complete information on eight sizes of a floor machine. Specifications and a detailed description of features are contained. Operation and application are clearly stated. Breuer Electric Mfg. Co.

Bronze Shapes (HHH) Semi-finished bearing-bronze shapes and special bar stock are the subjects of two recent bulletins. Special services include flange and split bushings, and thin wall sleeves. Bulletins include a weight chart for the full range of sizes. Magnolia Metal Co.

Colloidal (III) Published four-page pamphlet deals with colloidal graphite as an additive to industrial lubricants. A colloidal graphite dispersion for blending with petroleum products, to use in lubricating internal combustion engines and industrial machinery is described. The bulletin also discusses methods of blending, means of calculating dilutions, and advantages of heating during blending. Acheson Colloids Corp.

Protective Coatings (JJJ) Informative and well illustrated 42-page bulletin gives the story of this company's development of a plastic protective coating for building materials, metal tanks, mechanized equipment, and surfaces. Numerous before and after photographs are shown to indicate how the coating material is applied. Insul-Mastic Corp. of America.

Pipe Felt (KKK) Bulletin describes how steel piping can be protected from corrosion when it is placed in soil. Specifications and characteristics of this material are discussed and illustrated to bring out the advantages gained through its usage. Gama Industries, Inc.

Surface Coatings (LLL) Colorful eight-page bulletin covers details of this company's surface protective coating. Types and characteristics of the surface are explained, and what the coating will and will not protect is clearly stated. Several photographs illustrate equipment that has been coated to show its general application. Plastic Lining Corp.

Copper and Copper Alloy Index (MMM) Revised edition of "Copper and Copper Alloy Specifications Index" is now being offered. This 28-page index is in two sections: the first lists the generally used alloys; and the second lists specifications in numerical order with a brief description of the material. Side-indexed for ready reference. The American Brass Co.

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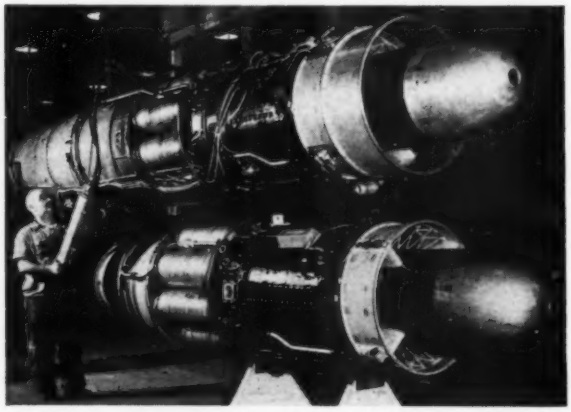
"SPOT" NEWS OF INDUSTRY

(Continued from page 121)

Many hours of maintenance and repair time are saved by allowing technicians free access to all the apparatus in the box without the necessity of removing insulation. Maintenance of the insulation is virtually eliminated since it is not applied to the equipment itself. The "dead air" space between the insulated box and the refrigeration equipment functions effectively as an added insulating medium.

Reheat Burner on Jet Engine Gives Planes Added "Punch"

Added thrust for Air Force planes is available now through the use of the elongated General Electric jet engine, which burns additional fuel in a "reheat" burner in the tail. By burning fuel in the tailpipe, in a method called "exhaust reheat", the thrust or driving force of the engine is increased.



The augmented engine was developed by the company's Aircraft Gas Turbine Div., Lynn, Mass., for the Air Force.

Another experimental reheat power plant—the thrust booster—is the result of a cooperative development by Republic Aviation Corp., NACA and General Electric. The reheat engine has a special nozzle at the end of the tailpipe, and the exhaust gases are discharged through this clamshell-like device. Movable lips, automatically controlled, change the area through which the hot gases must pass to obtain optimum performance from the engine under varying flight and power conditions.

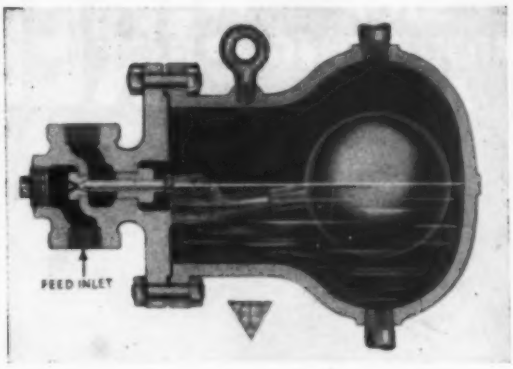
Natural Rubber Finds New Applications In Industry

Rubber latex in combination with certain types of dehydrated powders has, after a 15 year trial period, proved itself to be a most satisfactory material for ship floorings. The first ship application, made on the Queen Mary, was found to be resilient, adhesive to clean steel, non-corrosive, as well as non-flame and virtually non-smoke conducting.

Another use of natural rubber in business and industry is for rubber stamps of symbols in engineers' drawings. Great savings in time and cost can be made by using stamps rather than laboriously drawing the symbols.

Complete Test Equipment Checks Pump Characteristics and Operating Efficiency

Electric equipment recently installed at the Indianapolis plant of the Peerless Pump Div., Food Machinery Co., has given that company one of the most up-to-date pump labor-

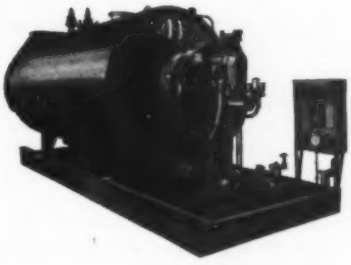


you get *plus-value* with Stets Type G regulators

Valve-in-end construction gives you simple, compact design that's built for maximum performance. You can get Stets Type G regulators in either piston or orifice valve units—250-400 w. s. p.—other types to 900#. Write today for bulletin 150 with full facts on the Stets new Low Pressure Type G Regulator.

STETS COMPANY

1440 BROADWAY — NEW YORK 18, N. Y.



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Completely Equipped and tested at factory.

Fully Automatic. Heavy Oil, No. 6.

60 to 500 Horsepower plus ample overload.

Efficiency and Capacity proved in every day practical service and fully guaranteed.

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For emergency shut-off of inflammable liquids or to divert water or steam to fire mains.

For diversion of water to sprinkler deluge or water curtain system or to divert inflammable liquids to a point of safety.

Get EVERLASTING VALVE *protection*

You are SURE of instant, unfailing safeguards when you install EVERLASTING VALVES operated with Pendulum Stop on your fire protection system.

When the weighted pendulum of this valve is released, there's not a moment of delay — the valve action is immediate and positive . . . the flow is full and unimpeded . . . there's no danger of sticking, binding or wedging.

And here's another important feature . . . the weighted pendulum can't damage the valve from impact at the bottom of its swing. No stop is needed to arrest the falling weight, because it disengages from the valve mechanism when its action is completed.

These valves are made in all sizes from 1 in. to 8 in. in metals to meet service conditions, and may be arranged for thermostatic, electrical or manual control from any location. Write for Bulletin E-52C describing these valves in detail.

EVERLASTING VALVE COMPANY
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Everlasting Valves
for everlasting protection

atories in the world. The equipment in general consists of G.E. dynamometers, adjustable voltage power supply, and control.

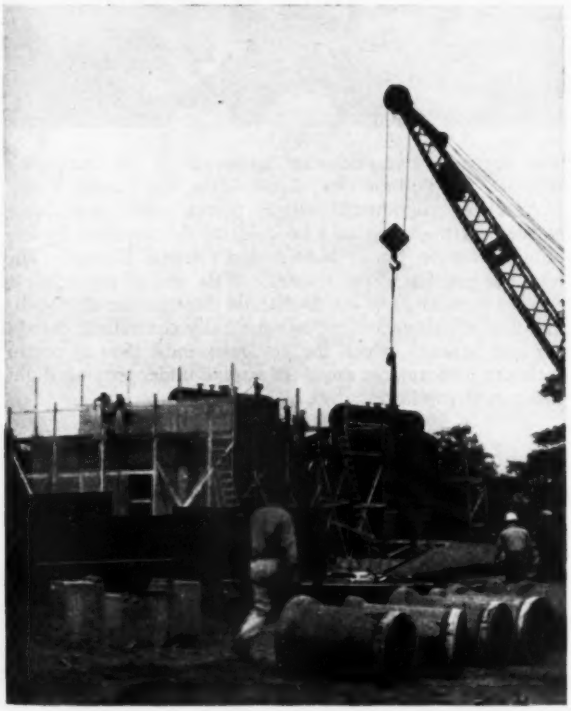
Engineers at Peerless will use the apparatus in extensive testing of centrifugal pumps to further the company's manufacturing and development program. The laboratory contains provision for 12 pump-testing stations. At the present time, dynamometer equipment has been set up for seven test stands. The tests correlate pump capacity with electric load characteristics to assure close adherence to specifications and high-efficiency operation of the pumps.

With the new equipment, Peerless technicians can determine accurately the characteristics of pumps ranging from 10 to 450 hp and from approximately 250 to 4,500 rpm. Electronic pre-amplifiers in the system in conjunction with amplidynes control speed within plus or minus 0.5%.

Four d-c dynamometers, rated 10 hp, 75 hp, 200 hp and 450 hp, comprise the bulk of the apparatus. All are 250-v units equipped with blowers, tachometer generators, and chronotachometers. The three smaller machines are ball-bearing cradled, and are rated at 1,500/4,500 rpm. The 450-hp dynamometer is sleeve-bearing cradled, rated at 1,100/3,600 rpm. Both the 200-hp and the 450-hp units feature motor-driven oil pumps.

Philadelphia Firm Uses Ozone Process to Purify River Water

An instrument known as a "dew-point recorder" and a new water-purification process is giving a spring-water taste to water from the Schuylkill River. The process, em-



POWER STATION IS PART OF $10 MILLION DISTILLERY

Power house and a waste disposal system using 5000 ft of vitrified clay pipe are going in simultaneously at Ashtabula, Ohio, site of National Distillers $10 million plant. Annual output will be 36,000,000 lb of sodium and 27,000 ton of chlorine. Clay pipe from 6 to 36 in. diam will be installed for industrial waste, sanitary and storm lines

ploying ozone to kill river-water bacteria, is being used at several water-purification plants in Philadelphia. The one at Welsbach Corp. is the largest water-purification plant in America.

In the ozone process, outside air is compressed, cooled and dried. This treated air is blown past banks of metal plates charged with high voltage. The electricity from the plates causes an electrostatic discharge producing ozone, an unstable form of oxygen.

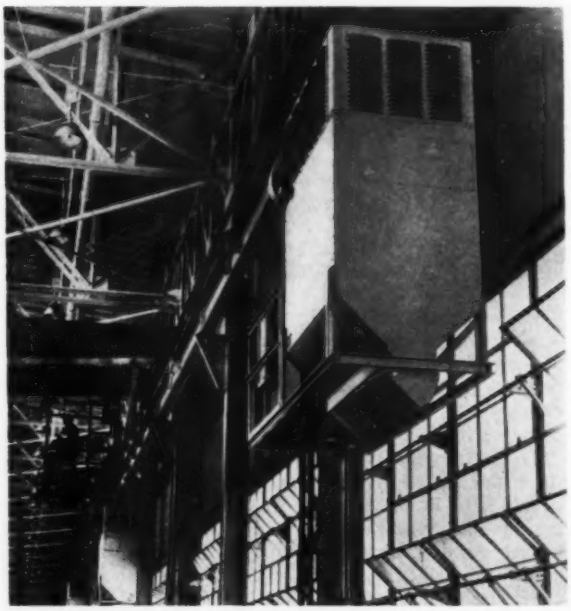
The air passing over the metal plates must have a very low moisture content. To assure that moisture in the air remains constant during the process, the dew-point recorder is used. Designed and built by G.E. engineers, the instrument gives a continuous record of air dryness. This is accomplished by measuring and recording the temperature when moisture in the air condenses on a mirror's surface.

Ozone is bubbled through river water after the sediment has been allowed to settle. Being an unstable gas, the ozone breaks down into ordinary oxygen, and in this process bacteria in the water are killed.

Ozone-treated water is filtered and pumped into city mains; only a trace of chlorine is added to protect its purity during the time it is in these mains.

Direct-Fired Space Heaters Maintain Ideal Temperature Conditions

Wall-hung direct-fired space heaters shown in the illustration will supply a blanket of warm air in one of the

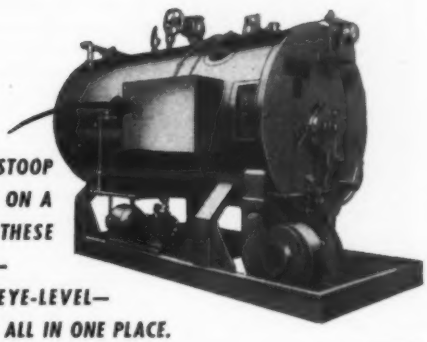


south's newest and largest industrial plants to maintain comfortable working temperatures for employees. The main building, housing a new copper-tube mill of Wolverine Tube Div. of Calumet and Hecla Consolidated Copper Co., Inc., at Decatur, Alabama, has an open floor area of more than six acres. It is longer than four football fields. This area is heated with 26 Dravo "Counterflo" heaters, each having an output of 1,000,000 Btu per hr. They are fired with propane gas. Thirteen heaters, spaced about 80 ft apart along each sidewall, discharge warm air across the 225 ft width of the mill building. Each heater handles about 11,000 cfm.

Return air is pulled through louvered openings at the

AMESTEAM GENERATOR ...Provides

EYE-LEVEL CONTROLS



NO NEED TO STOOP OR TO CLIMB ON A BOX TO SEE THESE CONTROLS— THEY'RE AT EYE-LEVEL— AND THEY'RE ALL IN ONE PLACE.

AMESTEAM Generator design provides a better automatic Unit — soundly engineered to meet your needs.

Controls are mounted in a sturdy metal panel box, located at eye-level — not only for your convenience in operation, but to provide maximum protection against damage by dust, splashing or carelessness.

That's only one of the AMESTEAM Generator's many advantages. All auxiliary equipment is completely accessible — simplified rear end design provides maximum ease of inspection, maintenance and cleaning — saving you time and money.

It all adds up to the easiest boiler to operate, clean and maintain — and it generates steam quickly, efficiently and at low cost.

Sizes 10 to 500 HP — 15 to 200 lbs. — arrange for Oil, Gas or Oil-Gas Combination.

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Controls valves or dampers in connection with heating or cooling coils, humidifiers, air washers, humidifying atomizers, spray nozzles, etc.

Used in processing and storage rooms in textile mills, industrial plants, laboratories, printing plants, telephone exchanges, and comfort air conditioning systems in all types of buildings.

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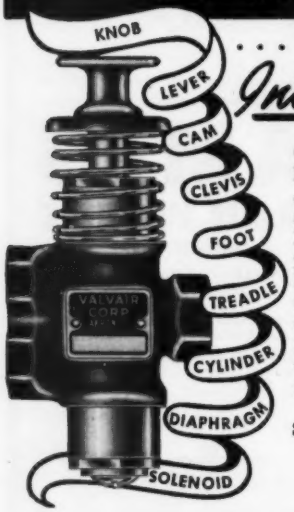
VALVAIR GIVES YOU . . . *Any* CONTROL ASSEMBLY ON A STANDARD VALVE BODY



. . . because parts are *Interchangeable*

Cylindrical ends on all valve bodies (in respective sizes) are identical, making possible *any control assembly*. Internally, stem, spacer, packer spreader, flange end bearings, and spring are interchangeable. Save on maintenance and stock; save by paying less for valves which embody standardized parts.

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Sizes: ¼", ⅜", ½", ¾", 1".

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VALVAIR CORPORATION • 454 Morgan Avenue, Akron 11, Ohio
AFFILIATE: SINCLAIR-COLLINS VALVE CO.

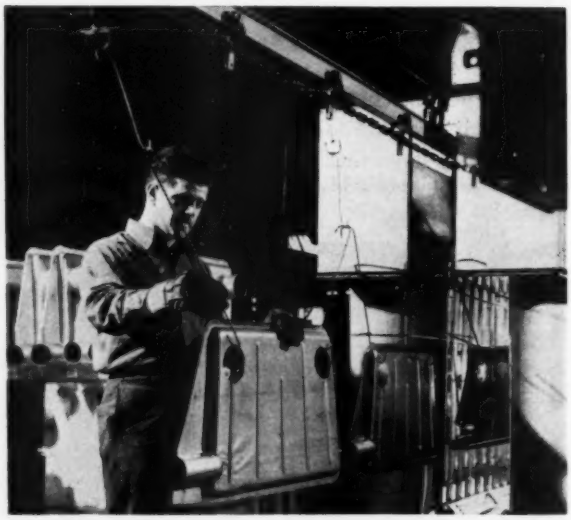
Rely Upon Valvair 2-WAY 3-WAY 4-WAY

tops of the heaters, the louvers being inverted from their standard position. Six larger Dravo heaters—three at each end of the building—temper fresh outside air brought in to replace air exhausted from the plant through ventilators over furnaces. All the heaters can be operated, without firing, for summer ventilation.

Radiant Heaters Increase Production and Reduce Costs

At Lawson Manufacturing Co., Pittsburgh, an improved and more economical method has been found to degrease sheet-metal parts for the floor furnaces they fabricate. All metal electric radiant heaters have replaced the vapor method, and conveyorizing the operation has eliminated the excess handling previously involved.

Degreasing 31x20-in. sheet metal parts is now done at a fraction of the cost of the old method. A continuous conveyor carries parts without interruption through a space-saving infrared oven that removes all trace of oil in 36 sec.



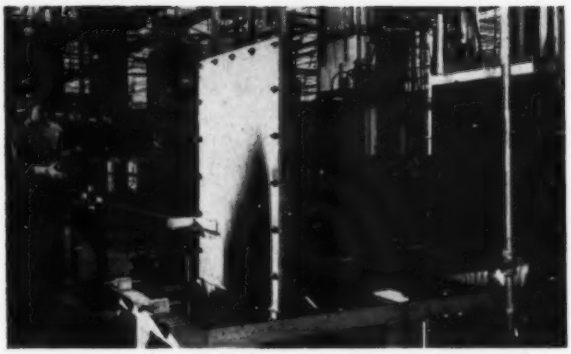
The oven consists of two banks of nine vertically mounted 3.6-kw Chromalox radiant heaters. Each bank has a heater at the base mounted on a 45-deg angle to increase the temperature on the bottom edge of the work. Total installed capacity is 72 kw. The heated section of the oven is approximately 3 ft long. The conveyor moves at 5 fpm.

During the 36 sec that parts move between heater banks, the temperature rises and vaporizes the oil coating. A total of 160 parts can be handled per hour at an electrical energy cost of one cent each; this cost is based on the plant's prevailing power rate. An economy factor is the oven's 2-min heatup time which permits the use of heat only as needed.

Oven efficiency was increased by insulating the space behind the heaters with glass wool. An overhead hood and a low-volume fan are used to exhaust fumes from the building.

Lithium-Vapor Heat-Treating Furnace Boosts Cylinder Production 100%

Walter Kidde & Co., Inc., has installed in their main plant a lithium-vapor furnace which is expected to speed up heat-treating of commercial steel cylinders by as much as 100% and vastly improve their surface quality. Designed and installed by the Lithium Co., the unit is the largest automatic furnace in the world combining the four heat-treating processes of hardening, quenching, degreasing, and drawing and cooling. A normalizing cycle is also provided.



Built at a cost of more than $100,000, the lithium-vapor furnace has a gas cracker to generate either the inert atmosphere employed to prevent scaling of the cold-drawn lightweight steel cylinders, or an atmosphere for carbon restoration. By excluding oxygen from the atmosphere within the furnace, the inert lithium vapor eliminates scaling troubles and gives a rust-inhibiting surface that is excellent for subsequent paint bonding.

One man can operate the fully automatic furnace through a panel of push-buttons. The only manual operations required are loading of the cylinders into specially constructed heat-resisting alloy trays. The trays carry the cylinders upright through the furnace on a series of conveyors and elevators.

Sound Movie On Color Available From Du Pont

"The Case for Color," a new 25-min 16-mm color sound movie explaining "Color Conditioning"—Du Pont Company's painting plan—has been released. Showings to interested parties may be arranged without cost by writing to the Finishes Div. at Wilmington, Del.

"Color Conditioning" involves the functional use of color

HUGE GENERATOR STATOR YOKE OFF TO SOUTH AMERICA

Enroute from the Allis-Chalmers Mfg. Co. to La Guaira, Venezuela, this 152,300-lb generator stator yoke is being loaded aboard the Grace Line's Santa Rosa in New York. The unit is destined for the Arrecife power station of La Electricidad de Caracas. Incidently, the Santa Rosa and her sister ship the Santa Paula are the only two vessels in regular service between New York and La Guaira capable of handling such a load with their own cargo gear

Where there's a will . . . There's a *better way!*

Yes! A ***faster, easier, more economical*** way to clean machinery and equipment. One blast from a powerful CLEMENTS-CADILLAC blower-suction cleaner does the trick — sends Dirt, Dust, and Grit scurrying from every crack and crevice. Use it for hard-to-get-at cleaning jobs all over your plant.

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Made in 5 models with attachments for every cleaning job.

PORTABLE COMBINATION BLOWER-SUCTION CLEANER

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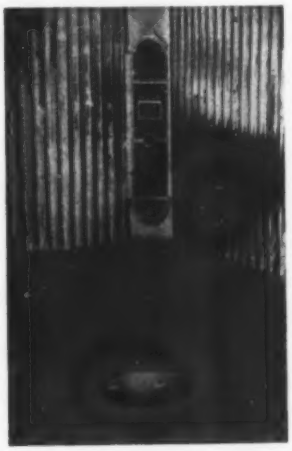
A large refinery plant was taking the time and trouble to replace the floors of their boiler by pounding a refractory in place. The average life of the floor was 44 days.

Then they switched to R & I Moldit Chrome, a castable refractory, which when mixed with water can be poured, troweled, shoveled or shot in place like concrete. Considerable installation time was saved and a service check at end of 96 days showed the Moldit Chrome still in good condition.



Many plants are now using this castable for both floors and walls of oil and coal-fired boilers. No pounding or ramming is needed and the life is longer.

Ask your supply house for R & I Moldit Chrome. Write us for Bulletin R-48.

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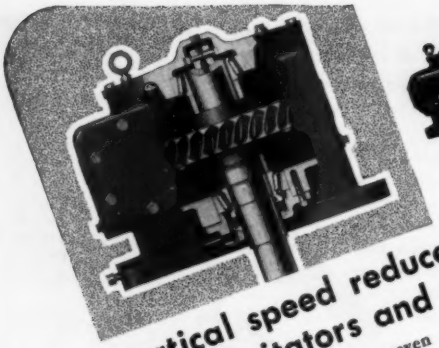

Type ND, with drive shaft down

A new vertical speed reducer to drive agitators and mixers

IMPROVED worm gear drive—in seven sizes each of two types—ready for prompt delivery. Designed especially for agitators and mixers, and for use with supplementary low-speed spur gear drives, without requiring outboard bearings. WRITE FOR BULLETIN 125, describing types NU and ND, with capacity charts and dimension data. The Cleveland Worm & Gear Co., 3253 East 80th St., Cleveland 4, Ohio.

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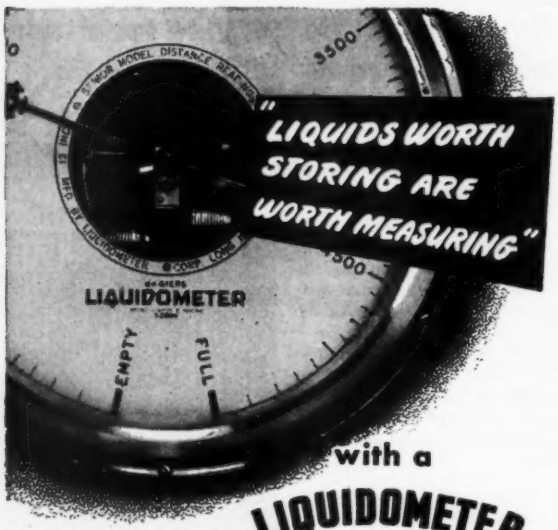
Worm Gear
Speed Reducers



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wherever people work or congregate. The movie shows its application in schools, industrial plants, hospitals, offices, and other buildings.

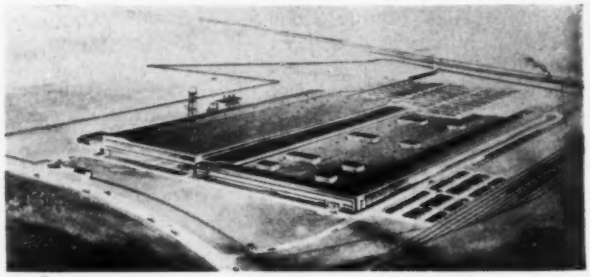
To demonstrate the importance of choosing the right colors, as well as some of the psychological effects color has on people, "The Case for Color" bases its story on three case histories. These involve an elementary classroom, an accounting office, and a restaurant. The film first shows what happened when color was misused, and then what happened after the same places were painted according to the principles of "Color Conditioning." Less eyestrain in school, better work in the office, and more "appetite appeal" in the restaurant were among the results obtained by the proper use of color.

"The Case for Color" is the second film Du Pont has made on the subject of "Color Conditioning." The first one dealt primarily with the application of its principles to industrial plants. The new one explains in greater detail how functional color may be used to advantage in a much wider field.

Waste Disposal System for $30 Million Ford Factory Will Use 5 Miles of Vitrified Clay Piping

Ford Motor Company's new $30 million stamping plant at Hamburg, N. Y., just west of Buffalo, will supply about 42% of all stampings used in the production of Ford, Mercury and Lincoln automobiles. Employing single-story design, the factory will contain over 1,000,000 sq ft of floor space.

This sprawling plant requires a sewer system that would dwarf a public system in a fair-sized American city. Over



5 miles of vitrified clay pipe drainage and sewage lines ranging from 6 to 36 in. dia must be laid before work begins on the superstructure.

The advent of big industries changes the requirements that must be met by the materials used in public sanitary systems, as many city engineers who have gone through this

experience are quick to point out. For one thing, industrial wastes are generally acid-charged. The corrosive factor reaches a new high; therefore, resistance to this new high incidence of corrision becomes the number one requirement in all specifications. And this must be considered not only

in the sewer lines that connect the big new industries, such as Ford's Hamburg plant, but also with relation to the entire community. Because big industries encourage little industries, a number of small plants may spring up that will discharge highly corrosive wastes into sewer lines not connected with the original industry.

George Miehls, engineer on the job is working out Ford's waste-disposal project in Hamburg. Design architect is F. A. Fairbrother. General contractors are Darin & Armstrong of Detroit. R. H. McManus & Co. installed the clay sewers and drains. Completion of the new plant is scheduled late in 1950.

Silver Powder Replates Electrical Connectors On the Job

Silver plating high-amperage electrical connections on the job is often desirable because it not only improves con-

tinuity of electrical service but also reduces maintenance time and costs. Furthermore, it offers a solution to the problem of heating due to oxidation. Even on connections where overheating is not apparent, silver plating prevents a series of losses too small to create noticeable heat but still accumulating into a major power loss.

The plating powder deposits a genuine coat of silver that will not peel off and gives cool maximum conductivity for copper, brass or bronze contacts. According to the Cool-Amp Co., it is harmless to the user and is simple to apply. The only equipment needed is a sharp steel wire brush or abrasive cloth, clean rag and water. One pound of the powder will silver plate approximately 6,000 sq in.

Hydrogen-Cooled Condenser Has Sealed off Exciter Housing

This assembled 355,000-lb Allis-Chalmers hydrogen-cooled synchronous condenser—rated 42,000/17,500 kva, 13,800 v, 720 rpm with a 180-kw 250-v enclosed exciter—is destined for the U. S. Department of Interior, Bonneville Power Administration, at Snohomish, Wash. The unit's exciter housing includes coolers and condenser collector rings. It can be sealed off from the rest of the condenser at standstill for inspection of commutator and collector assembly without loss of hydrogen from the condenser chamber.

Bearings in the condenser are ring oiled and water cooled with provision for high-pressure oil starting. The bearing

Is this the solution to your lubrication problems, too?

FOR more than 20 years, Farval has been saving money for users. Through efficient, dependable lubrication of machines and industrial equipment of all kinds, Farval saves 4 ways: It saves oiling labor, it saves lubricant, it reduces bearing expense, it eliminates down time.

The Farval System is a positive mechanical method of delivering oil or grease under pressure to a group of bearings from one Central Station, in exact quantities, as often as desired. It consists of a central pumping unit, two main supply lines and a measuring valve for each bearing.

Catalog No. 25 and "Case Studies" give you the facts and figures. The Farval Corporation, 3253 East 80th Street, Cleveland 4, Ohio.

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New *VERSENE test kit determines total water hardness in less than *TWO MINUTES***

Now, with this new Versene* water hardness testing kit you can determine the hardness of your own boiler, process or tap water as easy as ABC—in less than 2 minutes. Anyone who can tell red from blue can make this scientific versenate test and be accurate within one grain of hardness per gallon.

Handy, sturdy, pocket-size plastic kit contains 3 vials of chemicals and one combination measuring and mixing vial. More than 50 separate tests can be made, depending on water hardness. Complete instructions. Refills available.

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We also manufacture and supply di sodium versenate (the di sodium salt of ethylene diamine tetra-acetic acid). This is the reagent used in the Schwarzenbach Method for the determination of water hardness. It is an analytical reagent grade chemical.

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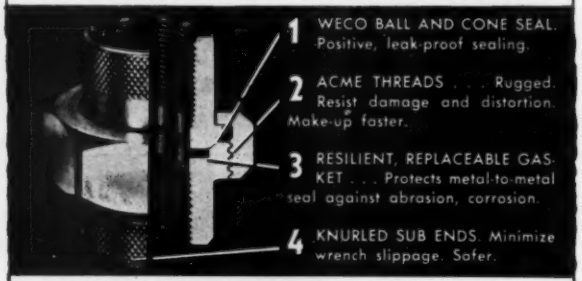
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Conveniently packaged in sturdy cartons—Sizes ⅛" through 1" packed 24 to carton; larger than 1" packed 12 to carton.

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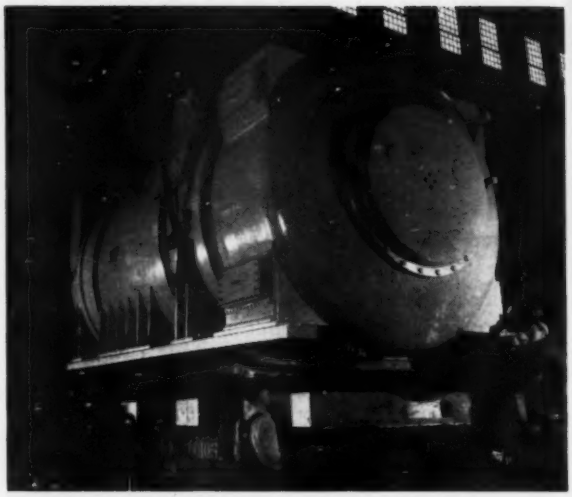


housings include overhead rails for block-and-tackle removal of bearing caps and bushings. The unit will use Regulex excitation and control equipment. The end plates shown in the illustration are special shipping plates instead of regular covers.

Ice Manufacturing Plant Changes From Steam to Electrical Power

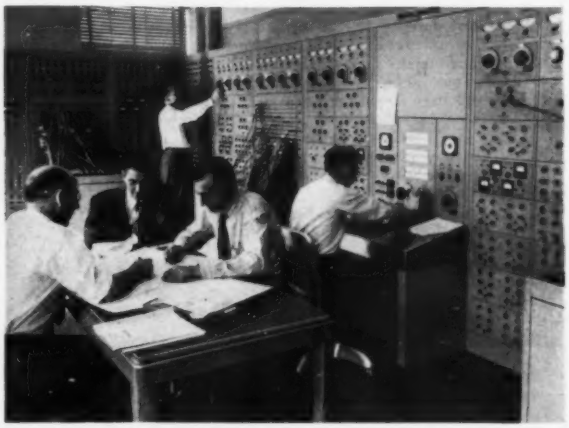
The Mountain Ice and Coal Co., one of the largest ice manufacturing plants in the Rocky Mountain area, recently completed a modernization program which includes $35,000 of G. E. equipment. The program centers around synchro-

nous and induction motors to drive York compressors; these replaced old steam-engine-driven compressors. Three synchronous motors are rated at 125 hp, 440 v, three phase, 60 cycle, 360 rpm. Each is direct-connected to a 10x10-in. two-cylinder vertical, single-acting ammonia compressor equipped with one-third and two-thirds manual capacity reduction bypass. A 1,200-rpm induction motor drives a 13x9-in. double-cylindered vertical, single-acting York ammonia booster compressor through a V-belt connection.

Analyzer Solves Network Problems

Engineers from the Metropolitan Edison Co., Reading, Pa., recently utilized General Electric's network analyzer in Schenectady to solve a series of network problems. Shown at

work on the analyzer are F. S. Fehr of Metropolitan Edison, standing between the network plugboards, and L. K. Kirchmayer, G. E. engineer, seated at the console. At the table are A. R. Deck (left) of the Metropolitan Edison, R. B. Hanford of G. E., and D. F. Krug from the utility.



The panels in the background contain the impedance units used to represent the network. These units are connected by the cords shown on the plugboard panels. The operator at the console reads watts, vars, volts and amperes at any point in the network by three electronic light beam instruments.

Wire-Rope Recommendations Available

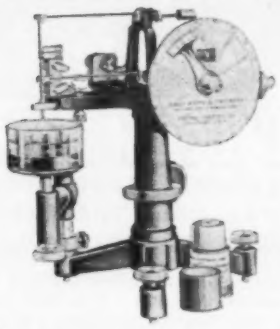
National Bureau of Standards has announced that a revision of Simplied Practice Recommendation 198-43, Wire Rope, has been approved for promulgation. Identified as R198-50, it becomes effective June 15; however, copies are available immediately from Superintendent of Documents, Government Printing Office, Washington, D. C.

The revised recommendation, which adds a new table and effects reduction in number of stock items, includes sizes, construction, grades, and breaking strengths of wire rope in a great variety of tonnages.

DUST COLLECTOR FANS HANDLE 225,000 CFM OF AIR

Six centrifugal-type fans (left) pull 225,000 cfm of air through the Westinghouse Precipitron electrostatic air cleaner (right) and deliver it to one of the paint rooms at Berger Mfg. Div., Republic Steel Co., Canton, Ohio. This installation removes airborne carbon and dust particles from the ventilating air for the paint room where metal wall-type and sink-type cabinets are painted white

Measures Surface Tension



Interfacial and surface tension measurements are extremely important in the testing and control of transformer, lubricating and Diesel engine oils. For example, in testing transformer oils the tensiometer readings indicate the sludge condition or breakdown point of the oil. This test eliminates costly burn out of transformers and saves on replacement oil.

The Cenco-duNouy Interfacial Tensiometer complies with the requirements of ASTM Method D971-48T, Interfacial Tension of Oil Against Water by the Ring Method.

Write for detailed information on No. 70540 Tensiometer, price, $302.50.

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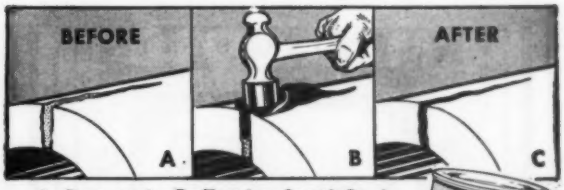

A—Deep crack. B—Tamping Smooth-On in. C—Crack completely sealed.

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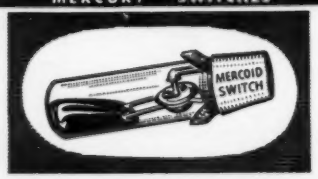

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AVAILABLE REPRINTS

Copies of the complete editorial section of the September, 1949 issue, describing the plant engineering activities of the General Motors Corporation are available in a separately bound brochure. Price including mailing is 50 cents.

We also have a few of copies of the following article reprints that are available free of charge to interested parties:

"Air Conditioning Cab Of Shovel Handling Steel Mill Slag", December, 1949.
"Boiler Houses Are Necessary Evils", February, 1950.
"Caribou Diesel Plant Built in a Hurry", February, 1950.
"Chain Belt's Newest Boiler is First 'Step' in 3-Step Plan", W. J. Thuerman, October, 1949.
"Commercial Solvents—Installs Boilers Out-of-doors", E. E. Kantz, April, 1949.
"Crankcase Explosions are Rare—But . . . " October, 1949.
"Electro-Motive's Steam Plant is Tops in Modernity", V. L. Wesby, September, 1949.
"Engineers 'Raise the Roof' for Harnischfeger's New Boiler", Anthony Sinclair, December, 1949.
"GM 'Utilities' Receive Major Attention", H. R. Smith, September, 1949.
"Goshen's 3200 HP Diesels Also Generate Steam", March, 1950.
"Grievances Can Be Avoided", April, 1950.
"How To Select Correct Steam Trap", Thomas Trail, January, 1950.
"Insulation on 2000 psi Boiler Proves Effective", R. H. Boothby, October, 1949.
"Keep It Clean, says Oldsmobile", R. H. Barlow and W. E. Rasmussen, May, 1949.
"A Lamson Installation", Calvin A. Burton, August, 1949.
"Low Cost Auxiliary Power From Turbine Drives", April, 1950.
"Modernization at Toledo Laundry Cuts Steam Costs in Half", H. A. Quinn and S. T. French, October, 1949.
"Petoskey Diesel Plant Designed With An 'Eye-to-The-Future' ", May, 1949.
"Progress Being Made In Shale-To-Oil Program", R. A. Cattell, November, 1949.
"Qualifications of an Effective Industrial Supervisor", A. A. Potter, June, 1949.
"Select Correct Batteries for Starting Diesels", K. A. Vaughn, November, 1949.
"Signode Plant 'Pressurized' to Eliminate Cold Drafts", November, 1949.
"Simplify Determinations of Pipeline Pressure Losses", J. O. Mullen and H. D. Fisher, November, 1949.
"Solvents vs. Sludge", Frank Ross, January, 1949.
"Steam, Air, and Power for 3 New Ford Assembly Plants", R. M. Doering, May, 1949.
"The Story of Thermal Electric", A. G. Purdue, March, 1949.
"Supervisors Must Develop Favorable Group Attitudes", Edmund Mottershead, November, 1949.
"Supervisor's Personal Check-Up Chart", November, 1949.
"Synchronous Motors Do Two Jobs at One Time", February, 1950.
"Unit Heaters Require Proper Steam Traps", P. J. Ulrich, March, 1949.
"Water Treatment for Air Conditioning Systems", Wm. A. Tanzola, May, June and July, 1949.

CARBORUNDUM BUILDS $2 MILLION PLANT IN WASHINGTON

Production of Carborundum silicon carbide has started at this plant in Vancouver, Wash. It will serve abrasive and refractory needs of growing industries on the west coast. Engineering and construction were under the directorship of The Nicholson Co., Inc., and in cooperation with Chemical Plants Div. of Blaw-Knox Construction Co.

Developments In Feedwater Treatment

(Continued from page 101)

causes of carryover may be divided into chemical and mechanical. Foaming is normally caused by chemical conditions, whereas priming and entrainment are caused by mechanical conditions.

Carryover is usually caused by one or a combination of the following:

1. High drum water-level.
2. Improper design or operation of the boiler and steam purification equipment.
3. Rapid changes in load.
4. Excessive concentration of suspended and/or dissolved solids in the boiler water.

Foaming is the only cause of carryover that is chemical in nature. Since we are dealing with water treatment, which involves chemical phenomena, we will deal only with foaming. This should not be construed to mean that foaming is the chief cause of carryover. Rather, the other factors often are of prime importance and definite corrective steps are called for.

Foaming is formation of a froth or foam on the surface of the boiler water. In severe cases, the foam layer may actually reach the steam outlet leading to severe carryover.

Pure water will not foam. Foaming is caused by the combined effect of suspended and dissolved solids in the boiler water. The reason that pure water does not foam is that the films of boiler water enclosing the steam bubbles are not strong enough to remain intact after they reach the water surface. Consequently, they rupture, and the film of water rejoins the boiler water proper. Suspended and dissolved solids "toughen" the films, causing them to remain intact after the steam bubbles reach the surface. An accumulation of these bubbles constitutes foam. This phenomenon is depicted in Fig. 6.

The toughening, or stabilization of the films can be explained on the basis of surface tension changes, and this fact is taken into consideration in corrective measures to control foaming.

Since suspended and dissolved solids are the cause of foaming, reduction of either or both will bring foaming under control. Blowdown will effectively reduce the concentration so foaming can usually be brought under control. Heat losses are costly and keeping blowdown at a minimum is desirable. Suspended solids are quite often the chief cause of stabilization of foam.

Organics may counteract this effect in two ways: (1) Suspended solids can be removed more effectively if they are treated. In this condition, the particles remain "fluid" and can be removed by blowdown. (2) Through protective colloid action of the organic, the suspended material can be kept in such a state of aggregation that it will not greatly cause foam stabilization. Through these methods carryover often can be controlled.

In cases of extremely bad water, or a combination of this condition and a mechanical cause of carryover, an organic may not control foaming. An anti-foam may then be used. Such materials prevent foam stabilization. In general, such materials must be fed continuously to the boiler. Only several parts per million are normally required. With an effective anti-foam, many times the normal concentration of total solids can be maintained; 10,000 to 30,000 ppm being experienced. In laboratory boilers, concentrations as high as 60,000 ppm are common.

In recent years considerable attention has been given to "volatilization" of silica with steam. Such silica may deposit in process equipment.

Volatilization of silica is due to hydrolysis of the nonvolatile silica to volatile silicic acid. Whether or not an ap-

THE HALLOWELL STEEL POSTURE STOOL

HALLOWELL Stools are constructed of heavy, pressed steel welded for strength, rigidity and long service. Simple, functional design invites the correct, comfortable posture that promotes worker productivity. Appearance is neat and attractive. Light weight, adjustable back rest and round seat appeal to women workers.

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Full details contained in Bulletin #704.

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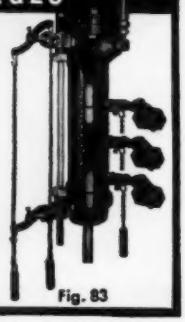
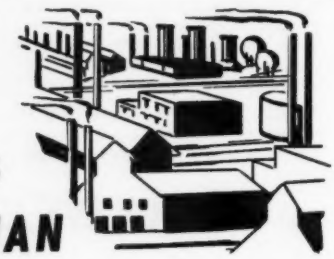


Fig. 83

Hajoca represents MORE THAN 1900 MANUFACTURERS



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preciable amount of silica will volatilize, depends on the pH of the water and the pressure. At a pH normally encountered in boiler water, that is over 10.5, silica does not volatilize appreciably below 900 F. At lower pH some silica will volatilize at pressures as low as 400 or 600 psi.

Ed. Note: Part 2, on the steam and condensate system will appear in July.

Coal-Fired Gas Turbine Developments

(Continued from page 87)

rpm on the steam turbine. At that point, the oil burner on the tempering line is ignited, and the unit then begins to accelerate. The preheater on the coal side is next ignited, and the unit accelerates still further.

By turning on the coal, the unit can be brought up to its rated speed of 5180 rpm, and on occasion it has been operated up to maximum permissible speed of 6000 rpm. At 10% overspeed, or 5700 rpm, the overspeed trip valve comes into action, bypassing the turbine, and also opening the anti-pumping valve.

The Houdry unit was installed for the dual purpose of demonstrating that coal can be successfully used as fuel for a full-scale gas turbine, and as a research installation to permit development of improved coal-handling, combustion, and flyash removal equipment. At the present time, it is being operated as many hours as possible each week, to determine the effect of the unremoved fine dust upon the turbine blades. After the first 150 hours of operation, inspection of the last row of blades indicates no damage whatever.

A very thin layer of fine dust adheres to the blades, but there is no evidence of any impairment of turbine performance. It is realized that the Houdry turbine is operating at a temperature much lower than a power-generating gas turbine, and it will not be safe to conclude that the problems of ash removal are solved satisfactorily, until a full-scale, full-temperature gas turbine has been operated on pulverized coal for thousands of hours. Performance of the Houdry turbine, however, indicates that at least partial solutions have been found to the fundamental problems of coal preparation and supply, combustion, and ash removal.

The first experimental locomotive will be composed of two units, with the power plant mounted on one, and the coal-preparation equipment, Fig. 7, on the other. Six-wheel trucks, identical to those used on 2000-hp diesel locomotives, will be employed.

The 4200-hp gas-turbine power plant manufactured by Allis-Chalmers has undergone preliminary tests. It will be moved to Dunkirk soon for extensive stationary tests in an installation, which will duplicate in every important par-

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ticular the arrangement to be followed in the locomotive.

The experimental coal-burning gas-turbine plant now in operation at Dunkirk incorporates ideas contributed by the many organizations that have cooperated in the program of the Locomtive Development Committee. Fred D. Buckley is the manager of this installation, and the smooth operation of the plant is due in large measure to the care with which the installation was planned by him and by Charles F. Kottcamp, formerly assistant to the director of research of the Locomotive Development Committee, and now chief fuels and lubrication engineer with the Gulf Oil Corp. Assistance of Allis-Chalmers is also gratefully acknowledged.

REFERENCES

(1) "Experimental Combustion of Pulverized Coal at Atmospheric and Elevated Pressures", by H. R. Hazard and F. D. Buckley, Trans. of A.S.M.E., Aug. 1948.

(2) "Studies on Flyash Errosion", Fisher and Davis, Mechanical Engineering, June 1949, pp 481.

(3) "The Coal-Burning Gas Turbine Locomotive", by J. I. Yellott, C. F. Kottcamp, P. R. Broadley, Preprint 47-A-118, A.S.M.E. 1947 Annual Meeting.

Monsanto Builds Process Steam Plant

(Continued from page 70)

boiler plant, and also the necessary pressure gages used by the fireman in his operation of the unit.

Steam is distributed from the boiler plant at two pressures. A pressure-reducing station is provided to regulate steam fed into a 16-in. low-pressure main which branches into two 12-in. arteries that run several thousand feet to the many process buildings. Similarly, a 12-in. main carries the steam at boiler pressure to two 10-in. arteries that parallel the low-pressure lines.

Safety is all important in the boiler plant, just as it is in the other departments making up Monsanto's wide spread chemical plant at Everett. Proper location of floors and galleries with interconnecting stairways provide access to all equipment and main stop valves. Since good housekeeping is found to go hand-in-hand with safe and efficient operation, every effort is made to keep the plant spotless. A pleasing color scheme consisting mainly of three tones of green is used on the boiler, the steelwork, the piping and the equipment. The walls on the ground floor are buff brick; on the operating floor the walls are buff glazed tile, while the floors are painted red. Zones have been created in the plant for cleaning and routine maintenance, with each fireman's helper assigned to a separate zone. This instills pride and competitive spirit in their routine chores. A high level of incandescent illumination is maintained at all times to aid in the safe operation and maintenance of equipment.

A preventive-maintenance program is being drawn up to put all inspection and routine maintenance on a regular basis to increase the reliability of the unit and to reduce repair costs.

ASA Announces Standard on Special Bolts

A new American Standard—High Strength, High Temperature Internal Wrenching Bolts, B18.8-1950 — is announced by the American Standards Association, 70 East 45 Street, New York 17, N. Y. As the name indicates, these bolts are intended for applications where high strength is required under high-temperature conditions, such as in steam-turbine assemblies. The bolts have a round head with a hexagonal recess, the head being larger than that of regular socket-head screws. When the round bolt head is located in a counterbore it may be peened to lock it against rotation.

The American Standard lists bolts in nominal diameters from $\frac{3}{8}$ to 2 in. Bolts up to $\frac{7}{8}$ in. inclusive have coarse threads, and larger bolts, 8-pitch threads according to the American Standard B18.1-1949.

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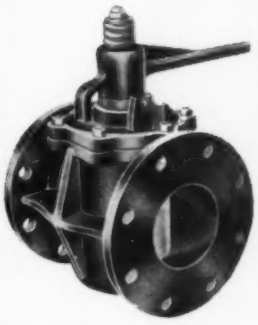

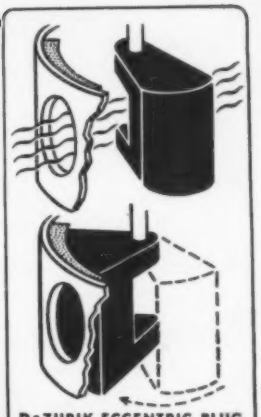

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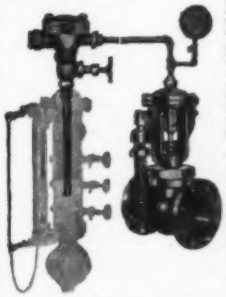

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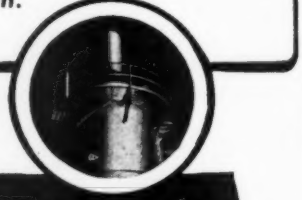

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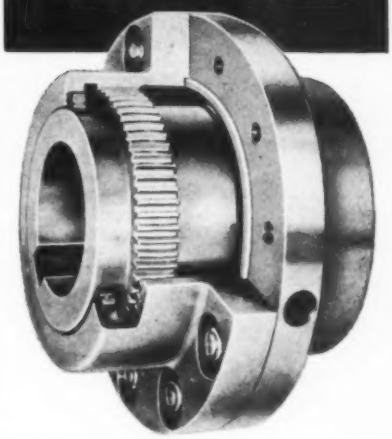

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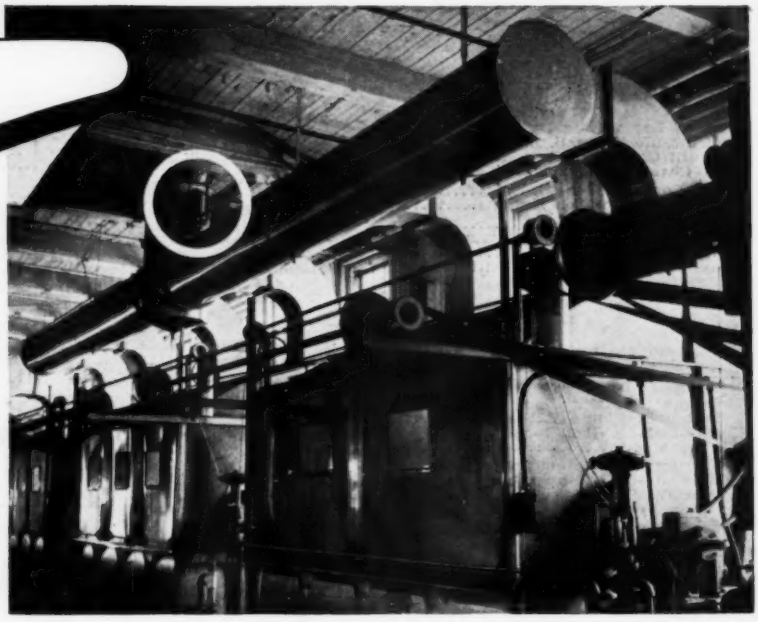

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